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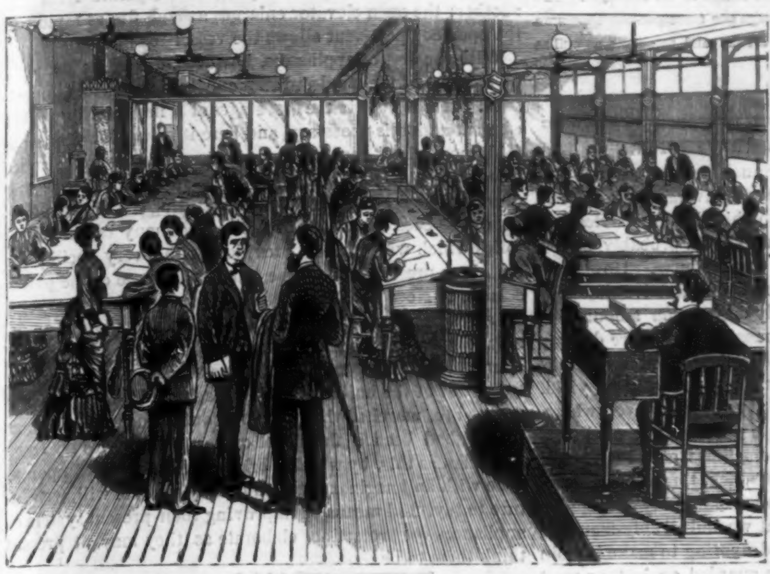

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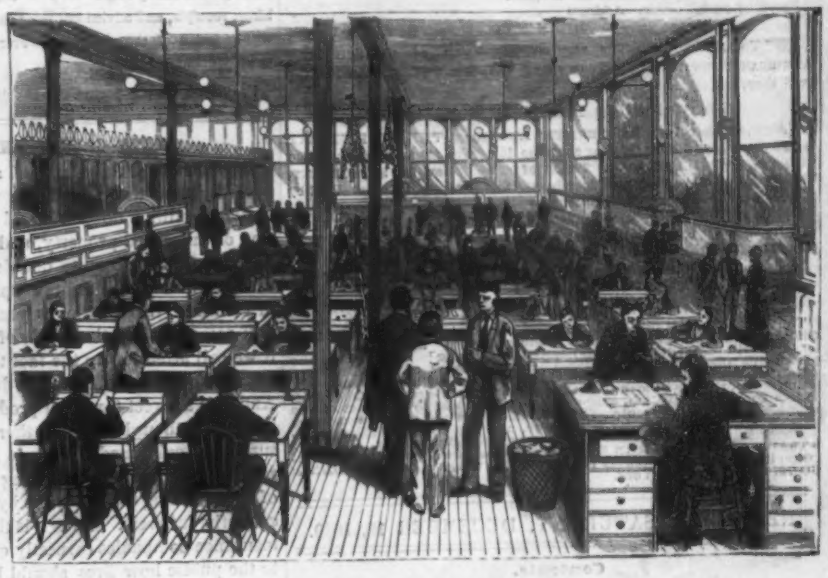

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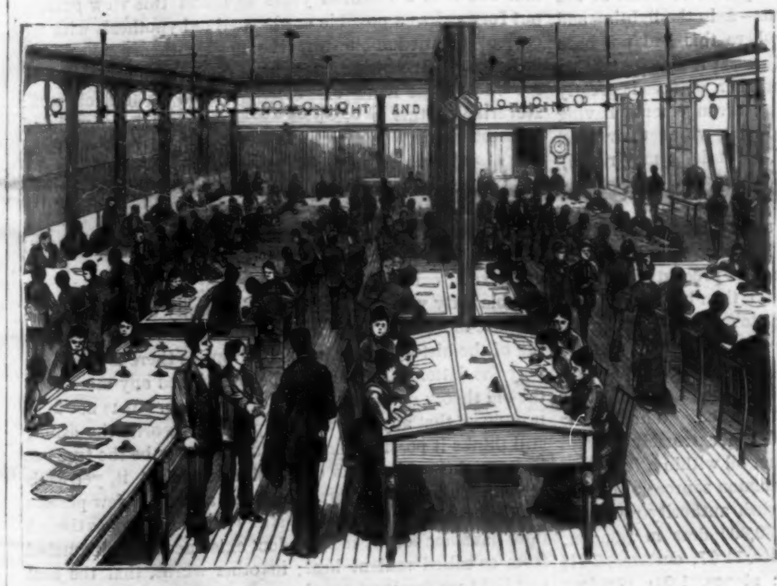

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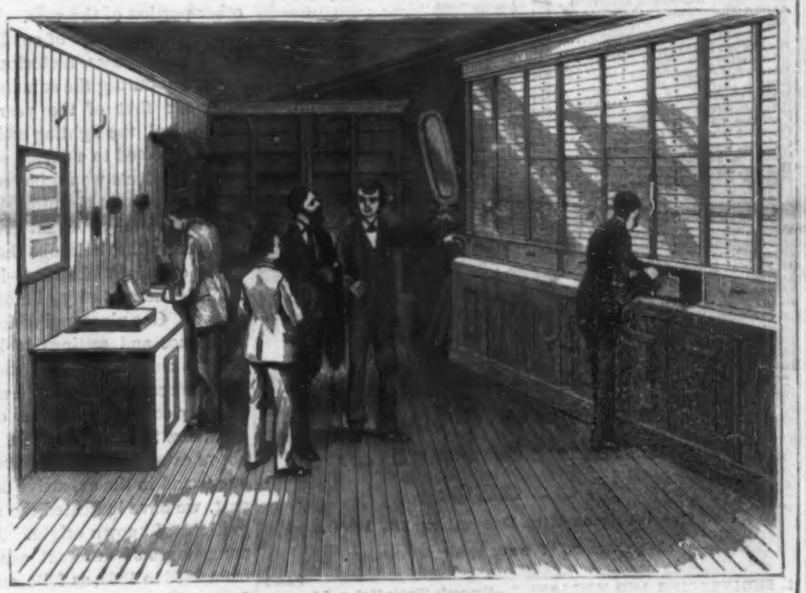

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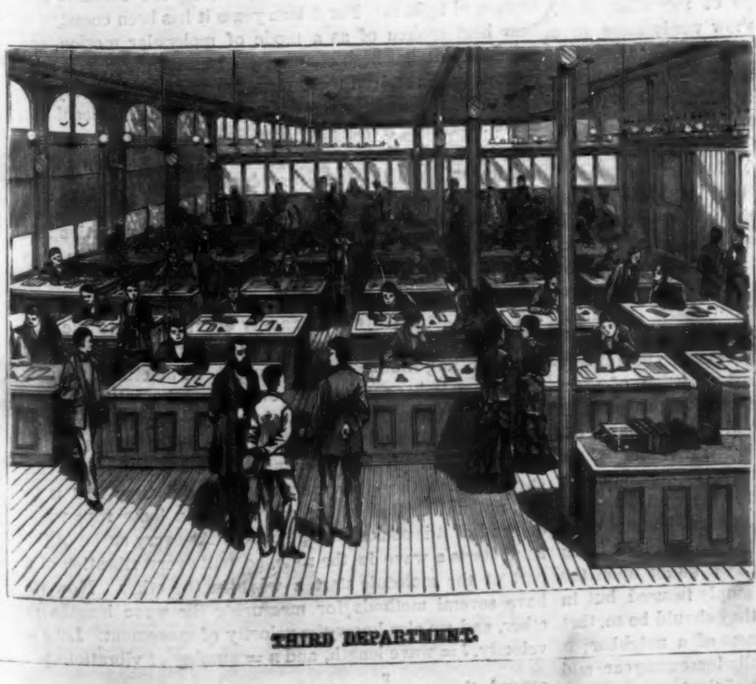

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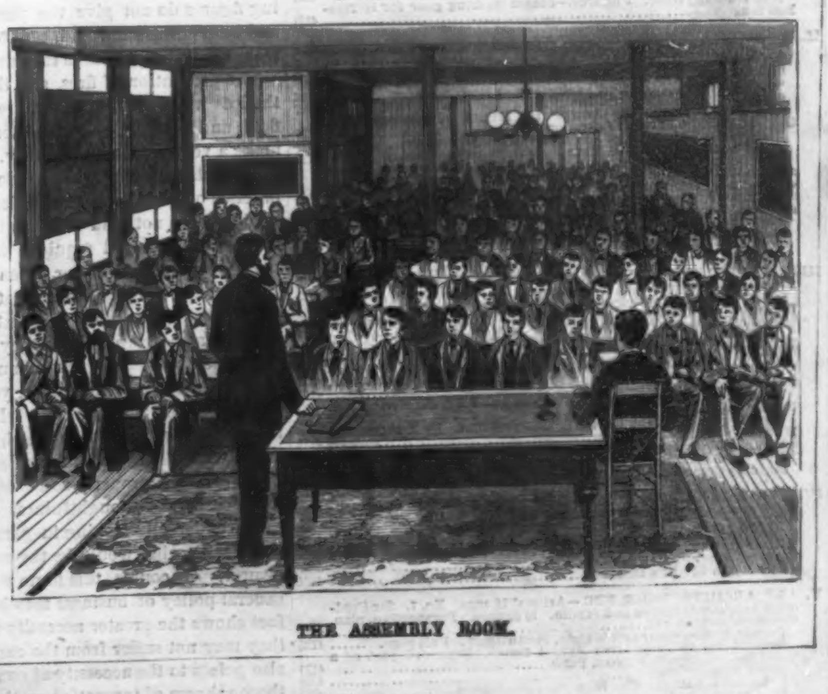

THE ASSEMBLY ROOM.

BUSINESS COLLEGES AND THEIR SYSTEMS.—[See page 388.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 18, 1880.

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FIRES—CAUSES AND PREVENTION.

It is estimated that the total annual losses of insured property by fire, throughout the world, average nearly two hundred million dollars. Add to this the annual destruction of uninsured property, and we should probably have a total amounting to quite double these figures. How great the loss, how severe the tax upon the productive industry of mankind, this enormous yearly destruction amounts to, will come home to the minds of most readers more directly if we call attention to the fact that it just about equals the value of our total wheat crop during a year of good yield. And it is a direct tax upon productive industry everywhere, because, although here and there a nominal loser, fully insured, has only made what is sometimes called "a good sale" to the companies holding his risk, this is only a way of apportioning the loss whereby the community at large become the sufferers. Thus it is that we find all ably-managed insurance companies earnestly endeavoring to make it plain to the public how fires should be guarded against, or most effectually localized and controlled when once started.

During the fall, or from "lighting up" time till about New Year's day, more fires occur ordinarily than in any other portion of the year. This fact points to some of the most general causes of conflagrations—as in the lighting and heating of houses, factories, etc., where this had not been necessary during the summer months. It is also found that after the first of the year the number of fires is greatly diminished, the lighting and heating arrangements having been subjected to a period of trial during which their most obvious defects would be remedied. While it may readily be conceded that the utmost care of the owner of property could not totally prevent great average losses from fire—for the greater the holdings the more must the proprietor trust to the oversight of others—it is evident that the above facts indicate the necessity of more strenuous precautions at this season. Gas pipes and fittings should then be tested; furnace flues and settings looked to; stove, heater, and grate fixtures and connections examined—and in all these particulars the scrutiny should be most closely directed to parts ordinarily covered up or out of sight, so that any defect or weakness from long disuse may be exposed. When to the above causes of fires we have added the extremely fruitful one found in the extensive use of coal oil within a few years past, we have indicated the most common sources of conflagrations of known origin. An English authority gives the percentages of different causes of 30,000 fires in London, from 1833 to 1865, as follows: Candles, 11·07; curtains, 9·71; flues, 7·80; gas, 7·65; sparks, 4·47; stoves, 1·67; children playing, 1·59; matches, 1·41; smoking tobacco, 1·40; other known causes, 19·40; unknown causes, 32·88. The foregoing figures do not give the percentage of incendiary fires, and later statistics would, no doubt, show vastly more fires from the use of kerosene than are here attributed to candles.

The prevention of fires, and the best means of minimizing the loss when they do occur, are topics which cover a wide field, and a collection of the literature on the subject would make a very respectable library. As the question presents itself to-day, it may well be doubted whether the general practice of large property holders of insuring all their possessions does not tend to lessen the constant vigilance which is the most essential requisite in preventing fires. Thousands of merchants never mean to keep a dollar's worth of goods in store or warehouse that is not fully covered by insurance, and they make this cost a regular charge upon their business as peremptorily as they do the wages paid the hands in their employ. But few manufacturers can so completely cover their risks by insurance, yet a large portion of them do so as far as they are able. It does not follow but that the larger portion of both merchants and manufacturers exercise what the law will fully decide is "due vigilance" in the care of the property so insured, but it is evident that in most cases the thoughtfulness is much less complete—the care wonderfully lacking in personal supervision—as compared with what would be the case were each one his own insurer. Of course, this in no way casts a doubt upon the general policy of business men being amply insured, but in fact shows the greater necessity why they should be so, that they may not suffer from the carelessness of a neighbor; it also points to the necessity of continually increasing care and thoroughness of inspection on the part of the insurance companies. These agencies, in fact, must compel the insured to keep up to the mark in the introduction of every improvement to ward off fires or diminish their destructiveness.

The progress made in this department during recent years has been great. The almost universal use of steam has been attended by the fitting up of factories with force pumps, hose, and all the appliances of a modern fire brigade; dangerous rooms are metal sheathed, and machinery likely to cause fire is surrounded by stationary pipes from which jets of water may be turned on instantaneously from the outside; stores and warehouses have standing pipes from which every floor may be flooded with water under pressure, and the elevators, those most dangerous flues for rapidly spreading a fire, are either bricked in entirely or supposed to be closed at every floor. The latter point, however, is sometimes forgotten, as sea captains forget to keep the divisions of their vessels having watertight compartments separate from one another; the open elevator enlarges a small fire as rapidly as the open compartment allows the vessel to sink.

With the best of appliances, however, discipline and drill on the part of the hands, in all factories, is of prime importance. It is always in the first stages of a fire that thoroughly efficient action is necessary, and here it is worth a thousandfold more than can be any efforts after a fire is once thoroughly started. Long immunity is apt to beget a feeling of security, and the carelessness resulting from overconfidence has been the means of destroying many valuable factories which were amply provided with every facility for their own preservation. The teachers in some of the public schools of New York and Brooklyn, during the past year, set an example which some of our millowners might profitably follow. There have been cases when, from a sudden alarm of fire, children have been crushed in their crowding to get out of the building. The teachers, in the instances referred to, marched their children out, under discipline, as if there had been a fire. Let owners of factories try some such plan as this, by which workmen may be called upon to cope with an imaginary fire, and many of them will, we venture to say, find means of improving their present system or appliances for protection, elaborate as they may at present think them to be.

WHAT IS LIGHT?

If on opening a text book on geology one should find stated the view concerning the creation and age of the earth that was held a hundred years ago, and this view gravely put forward as a possible or alternative hypothesis with the current one deducible from the nebula theory, one would be excused for smiling while he turned to the title page to see who in the name of geology should write such stuff. Nevertheless this is precisely similar to what one will find in most treatises on physics for schools and colleges if he turns to the subject of light. For instance, I quote from a book edited by an eminent man of science in England, the book bearing the date 1873.

"There are two theories of light; one the *emissive* theory; . . . the other, the *vibratory* theory;" just as if the emissive or corpuscular theory was not mathematically untenable sixty years ago, and experimentally demonstrated to be false more than forty years ago. Unless one were treating of the history of the science of optics there is no reason why the latter theory should be mentioned any more than the old theory of the formation of the earth. It is not to be presumed that any one whose opinion is worth the asking still thinks it possible that the old view may be the true one because the evidence is demonstrable against it, yet while the undulatory theory prevails there are not a few persons well instructed otherwise who still write and speak as though light has some sort of independent existence as distinguished from so-called radiant heat; in other words, that the heat and light we receive from the sun are specifically different.

A brief survey of our present knowledge of this form of energy will help to show how far wrong the common conception of light is. For fifteen years it has been common to hear heat spoken of as a mode of molecular motion, and sometimes it has been characterized as *vibratory*, and most persons have received the impression that the vibratory motion was an actual change of position of the molecular in space instead of a *change of form*. Make a ring of wire five or six inches in diameter, and, holding it between the thumb and finger at the twisted ends, pluck it with a finger of the other hand; the ring will vibrate, have three nodes, and will give a good idea of the character of the vibration that constitutes what we call heat. This vibratory motion may have a greater or less amplitude, and the energy of the vibration will be as the square of that amplitude. But the vibrating molecule gives up its energy of vibration to the surrounding ether; that is to say, it loses amplitude precisely as a vibrating tuning fork will lose it. The ether transmits the energy it has received in every direction with the velocity of 186,000 miles per second, whether the amplitude be great or small, and whether the number of vibrations be many or few. It is quite immaterial. The *form* of this energy which the ether transmits is *undulatory;* that is to say, not unlike that of the wave upon a loose rope when one end of it is shaken by the hand. As every shake of the hand starts a wave in the rope, so will every vibration of a part of the molecule start a wave in the ether. Now we have several methods for measuring the wave lengths in ether, and we also know the velocity of movement. Let v = velocity, l = wave length, and n = number of vibrations per second, then $n = \frac{v}{l}$, and by calculation the value of n varies within wide limits, say from 1×10^{14} to 20×10^{14}. But all

vibrating bodies are capable of vibrating in several periods, the longest period being called the *fundamental*, and the remainder, which stand in some simple ratios to the fundamental, are called *harmonics*. Each of these will give to the ether its own particular vibratory movement, so that a single molecule may be constantly giving out rays of many wave lengths precisely as a sounding bell gives out sounds of various pitches at one and the same time.

Again, when these undulations in the ether fall upon other molecules the latter may reflect them away or they may absorb them, in which case the absorbing molecules are themselves made to vibrate with increased amplitude, and we say they have been heated. Some molecules, such as carbon, appear to be capable of stopping undulations of all wave lengths and to be heated by them; others are only affected by undulations of particular wave lengths, or of wave lengths between special limits. In this case it is a species of sympathetic vibration. The distinction between the molecular vibrations, and the undulations in ether that result from them, must be kept in mind, as must also the effect of the undulations that fall upon other molecules. To one the name *heat* is applied, to the other the name of *radiant energy* is given; and it matters not whether the undulations be long or short, the same molecule may give out both.

Now let a prism be placed in the path of such rays of different wave length from a single molecule, and what is called the dispersive action of the prism will separate the rays in the order of their wave lengths, the longer waves being less refracted than the shorter ones; but the energy of any one of these will depend upon the *amplitude of undulation*, which in turn will depend upon the amplitude of vibration of the part of the molecule that originated it, but in general the longer waves have greater amplitude, though not necessarily so. Consequently, if a thermopile be so placed as to receive these various rays, and their energy be measured by its absorption on the face of the pile, each one would be found to heat it, the longer waves more than the shorter ones, simply because the amplitude is greater, but for no other reason, for it is possible, and in certain cases is the fact, that a short wave has as much or more energy than a longer one. If the eye should take the place of the thermopile it would be found that some of these rays did not affect it at all, while some would produce the sensation of light. This would be the case with any waves having a wave length between the limits of, say, 1-37,000 of an inch and 1-60,000 of an inch; any shorter waves will not produce the sensation of light. If instead of the eye a piece of paper washed in a solution of the chloride of silver should be placed where the dispersed rays should fall upon it, it would be found that only the shorter waves would affect it at all, and among these shorter ones would be some of those rays which the eye could not perceive at all.

It was formerly inferred from these facts that the heat rays, the light rays, and the chemical rays were different in quality; and some of the late books treating upon this very subject represent a solar spectrum as being made up of a heat spectrum, a light spectrum, and an actinic or chemical spectrum, and the idea has often been made to do duty as an analogy in trinitarian theology; nevertheless it is utterly wrong and misleading. There is no such thing as an actinic spectrum; that is, there are no such rays as special chemical rays; any given ray will do chemical work if it falls upon the proper kind of matter. For instance, while it is true that for such salts of silver as the chloride, the bromide, etc., the shorter waves are most efficient; by employing salts of iron one may get photographic effects with wave lengths much too long for any eye to perceive. Capt. Abney has photographed the whole solar spectrum from one end to the other, which is sufficient evidence that there are no special chemical rays. As to the eye itself, certain of the wave lengths are competent to produce the sensation we call light, but the same ray will heat the face of a thermopile or produce photographic effects if permitted to act upon the proper material, so there is no more propriety in calling it a light ray than in calling it a heat ray or an actinic ray. What the ray will do depends solely upon what kind of matter it falls upon, and all three of these names, *light*, *heat*, and *actinism*, are names of *effects of radiant energy*. The retina of the eye is itself demonstrably a photographic plate having a substance called purpurine secreted by appropriate glands spread over it in place of the silver salts of common photography. This substance purpurine is rapidly decomposed by radiant energy of certain wave lengths, becoming bleached, but the decomposition is attended by certain molecular movements; the ends of the optic nerves, which are also spread over the retina, are shaken by the disrupting molecules, and the disturbance is the origin of what we call the sensation of light. But the sensation is generally a compound one, and when all wave lengths which are competent to affect the retina are present, the compound effect we call white or whiteness. When some of the rays are absent, as, for instance, the longer ones, the optical effect is one we call green or greenness; and the special physiological mechanism for producing the sensation may be either three special sets of nerves, capable of sympathetic vibration to waves of about 1-39,000, 1-45,000, and 1-55,000 of an inch in length, as Helmholtz has suggested, or, as seems to the writer more probable, the substance purpurine is a highly complex organic substance made up of molecules of different sizes and requiring wave lengths of different orders to decompose them, so that a part of the substance may be quite disintegrated, while other molecules may be quite entire throughout the visual space. This will account for most of the chromatic effects of vision, for complementary colors, and for color blindness, by supposing that the purpurine is not normally constituted. This is in accordance with experimental photography, for it has been found that the long waves will act only upon heavier molecules. It is true vision may be good when there is no purpurine, but there is no doubt but that this substance is secreted in the eye, and that it is photographic in its properties, and so far must be taken as an element in any theory of vision; but the chief point here considered is that objectively light does not exist independent of the eye, that light is a physiological phenomenon, and to speak of it otherwise is to confound a cause with an effect. It is, hence, incorrect to speak of the velocity of light; it has no velocity. It is *radiant energy* that has the velocity of 186,000 miles a second. It is incorrect to say we receive heat from the sun. What we do receive is *radiant energy*, which is here transformed into heat. This is not hypercritical, but is in accordance with the knowledge we have to-day. The old nomenclature we use, but without definite meaning; the latter is left to be inferred from the connection or context. If a man should attach to the water main in a city a properly constructed waterwheel, the latter will rotate; but it would not be proper to say that he received rotation from the reservoir. What he received was water with a certain pressure; in other words, a certain form of energy, which he transforms into rotation by the appropriate means; but by substituting other means he can make the same water pressure maintain a vibratory motion, as with the hydraulic ram valve, or let it waste itself by open flow, in which case it becomes ultimately molecular vibration that is heat. The analogy holds strictly. The trouble all comes from neglecting to distinguish between different forms of energy—energy in matter and energy in the ether.

GLASS SPINNING AND WEAVING.

Quite recently a Pittsburg glass firm has succeeded, to a notable degree, in producing glass threads of sufficient fineness and elasticity to permit of their being woven into fabrics of novel character and quality. Their success is such as to warrant the assumption that garments of pure glass, glistening and imperishable, are among the possibilities of the near future. The spinning of glass threads of extreme fineness is not a new process, but, as carried on at present by the firm in question—Messrs. Atterbury & Co.—possesses considerable interest. From a quality of glass similar to that from which table ware is made, rods of glass averaging half an inch in diameter are drawn to any desired length and of various colors. These rods are then so placed that the flame of two gas burners is blown against that end of the rod pointed toward the large "spinning" wheel. The latter is 8½ feet in diameter, and turns at the rate of 300 revolutions per minute. The flames, having played upon the end of the glass cylinder until a melting heat is attained, a thread of glass is drawn from the rod and affixed to the periphery of the wheel, whose face is about 12 inches wide. Motion is then communicated, and the crystal thread is drawn from between the gas jets and wrapped upon the wheel at the rate of about 7,500 feet per minute. A higher speed results in a finer filament of glass, and *vice versa*. During its passage from the flame to the wheel, a distance of five or six feet, the thread has become cooled, and yet its elasticity is preserved to a notable degree. The next step in the process consists in the removal of the layers of threads from the wheel. This is easily accomplished, and after being cut to the desired lengths, the filaments are woven in a loom somewhat similar to that used in weaving silken goods. Until within the past few weeks only the woof of the fabric was of glass, but at present both warp and woof are in crystal. Samples of this cloth have been forwarded to New York and to Chicago, and the manufacturers claim to be able to duplicate in colors, texture, etc., any garments sent them. A tablecloth of glass recently completed shines with a satiny, opalescent luster by day, and under gaslight shows remarkable beauty. Imitation plumes, in opal, ruby, pale green, and other hues, are also constructed of these threads, and are wonderfully pretty. The chief obstacle yet to surmount seems to lie in the manipulation of these threads, which are so fine that a bunch containing 250 is not so thick as an average sized knitting needle, and which do not possess the tractability of threads of silk or cotton.

[The foregoing information is furnished by a correspondent in Pittsburg. A sample of the goods mentioned, a tablecloth of glass, is now on exhibition in this city.

The weaving of such heavy fabrics of glass for ornamental purposes and for curiosities is no new thing; nor, in our estimation, does comparative success in such experiments warrant the enthusiastic claims of the Pittsburg manufacturers touching the adaptability of glass for wearing apparel. Unless it is in their power to change the nature of glass absolutely and radically, it does not seem possible for them so to overcome the ultimate brittleness of the separate fibers as to make the fabric fit to be brought in contact with the skin. The woven stuff may be relatively tough and flexible; but unless the entire fabric can be made of one unbreakable fiber the touch of the free ends, be they never so fine, must be anything but pleasant or beneficial, if one can judge by the finest filaments of glass spun hitherto. Besides, in weaving and wearing the goods, a certain amount of fiber dust must be produced as in the case of all other textile material. When the softest of vegetable fibers are employed the air charged with their fragments is hurtful to the lungs; still more injurious must be the spiculæ of spun glass.

However, although the manufacturers are likely to be disappointed in their expectation of finding in glass a cheap and available substitute for linen, cotton, and silk in dress goods, it is quite possible that a wide range of useful application may be found for their new fabric.]

REMARKABLE ERUPTION OF MAUNA LOA.

Late advices from the Sandwich Islands describe the eruption of Mauna Loa, which began Nov. 5, as one of the grandest ever witnessed. The opening was about six miles from the summit of the mountain, and already two great streams of lava had been poured out; one of them, from one to two yards wide and twenty feet deep, had reached a distance of thirty miles. Terrible explosions accompany the flow of the lava stream, which for a time threatened the town of Hilo; at last reports the flow seemed to be turning in another direction.

Mauna Loa, "long or high mountain," occupies a large portion of the central and southern part of the island of Hawaii, and reaches an elevation of 13,760 feet. It has been built up by lavas thrown out in a highly fluid state, and flowing long distances before cooling; as a consequence the slopes of the mountain are very gentle, averaging, according to Prof. Dana, not more than six and a half degrees. Its craters are numerous, and usually occur near the summit and on the sides, new ones opening frequently, and furnishing, as in the latest instance, magnificent lava streams. The terminal crater is circular, 8,000 feet in diameter, and in 1864 was about 1,000 feet deep. In 1859 an enormous lava fountain spouted from this crater for four or five days, throwing a column of white hot fluid lava about 200 feet in diameter to the height of two or three hundred feet. The lava stream ran 50 miles to the sea in eight days. Other great eruptions have occurred in 1832, 1840, 1843, 1852, 1855, 1868 and 1873. The lava streams poured out in 1840, 1859, and 1868, flowed to the sea, adding considerably to the area of the island. Those of 1843 and 1855 are estimated to have poured out respectively 17,000,000,000 and 38,000,000,000 cubic feet of lava. In 1868 the lava stream forced its way under ground a distance of twenty miles, and burst forth from a fissure two miles long, throwing up enormous columns of crimson lava and red hot rock to the height of five or six hundred feet.

On the eastern part of Mauna Loa, 16 miles from the summit crater, is Kilauea, the largest continuously active crater in the world. It is eight miles in circumference, and 1,000 feet deep. Its eruptions are generally independent of those of Mauna Loa.

NEW AIR ENGINE.

A valuable improvement in compressed air engines has recently been patented in this country and in Europe by Col. F. E. B. Beaumont, of the Royal Engineers, and we learn from accounts given in the London and provincial papers that it has proved highly efficient and satisfactory.

The engine possesses some peculiar features which render it very economical in the use of compressed air. It has two cylinders, one being much larger than the other. Into the smaller of these cylinders the compressed air is taken directly from the reservoir, and after doing its work there it is discharged into the larger cylinder, where it is further expanded, being finally discharged into the open air.

The admission of air to the smaller cylinder is regulated by an adjustable cut-off apparatus, which admits of maintaining a uniform power under a variable pressure. When the reservoir at first starting contains air at a very high pressure, the cut-off is adjusted so that the small cylinder receives a very small charge of air at each stroke; when the pressure in the reservoir diminishes the cut-off is delayed so that a larger quantity of air is admitted to the small cylinder; and when the pressure in the reservoir is so far reduced that the pressure on the smaller piston gives very little power, the supply passages are kept open so that the air acts directly on the piston of the larger cylinder. This arrangement is also available when the air pressure is high and great power is required for a short time, as, for example, in starting a locomotive.

It is, perhaps, needless to mention the advantages a motor of this kind possesses over the steam locomotive. The absence of smoke and noise renders it particularly desirable for tunnels, elevated roads, and, in fact, for any city railroad.

Further information in regard to this important invention may be obtained by addressing Mr. R. Ten Broeck, at the Windsor Hotel, New York.

Telegraph Wires Underground.

Philadelphia newspapers report that the American Union Telegraph Company are about to try in that city the experiment of putting their wires underground. The plan works well enough in European cities, and there would seem to be no reason why it should not succeed here, save the indisposition of the companies to bear the first cost of making the change. For some months the Western Union Telegraph Company has had the matter under consideration, but will probably wait until pressed by a rival company before it undertakes the more serious task of taking down its forest of poles and sinking the wires which contribute so much to the prevailing ugliness of our streets. Sooner or later the poles and wires must come down; and it is altogether probable that the change will be beneficial to the companies in the long run, owing to the smaller cost of maintaining a subterranean system. It will certainly be an advantage to the community.

IMPROVED SAFETY NUT.

That a safety nut so simple and so obviously efficient as the one shown in the annexed engraving should be among the recent inventions in this line instead of being among the first, is a curious example of the manner in which inventors often overlook the simplest means of accomplishing an end. The principle on which this nut operates will be understood by reference to the engraving. Two nuts are represented on each bolt, simply for the purpose of showing the difference between the nut when loose and when screwed down. In practice only one nut is required to each bolt.

The square nut shown in Fig. 1 is concaved on its under side, so that it touches its bearings only at the corners and in the outer face of the nut there are two slots at right angles to each other. When this nut is screwed home the outer portion is contracted so as to clamp the bolt tightly.

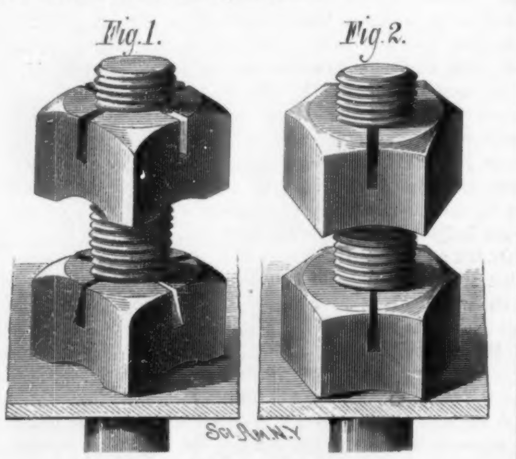
The hexagonal nut shown in Fig. 2 has but a single transverse slot, and the nut is made concave on the under surface, so that when the nut is screwed home it will contract the outer portion and so clamp the bolt.

This nut may be removed and replaced by means of the wrench, but it will not become accidentally loosened, and the bolt to which it is applied will always remain tight, as the nut possesses a certain amount of elasticity. The action of this nut is such as to prevent stripping the threads of either bolt or nut.

As only one nut is used with each bolt, and as no washer or other extra appliance is required, it is obvious that a great saving is effected by this invention.

We are informed that several of the leading railroads have adopted this nut, and use it on the tracks, engines, cars, and machinery. The Atwood Safety Nut Company manufacture this article in a variety of forms.

Fig. 1. Fig. 2.



THE ATWOOD SAFETY NUT.

Further information may be obtained by addressing J. W. Labaree, Secretary and Treasurer, Room 2, Agawam Bank Building, Springfield, Mass.

Petroleum Prospects.

The total oil production of the Pennsylvania oil regions for the month of October was 2,094,608 barrels. The conditions in the producing field are gradually giving warrant for permanently higher prices of crude. The confidence of the trade is daily becoming more fixed in the definiteness and limit of the Bradford field, as the last of the several "rich streaks" in the region are being worked.

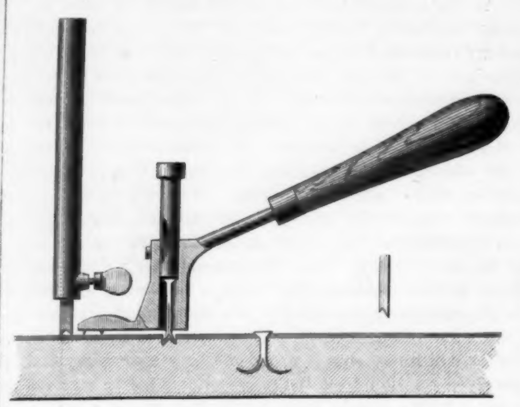
We entertain an increased belief that the coming year will exhibit a continued falling off in the volume of production, notwithstanding all the modern improvements in drilling and the great energy with which they are employed.

For the past few weeks the markets of both crude and refined seem to have been rigorously and artificially held by the refining interest. The refined has been quoted at 12 cts. for four weeks without change—and as a consequence the exporter has taken oil very sparingly. The exports of last year to November 1, as compared with the exports of this year to November 1, show a decrease of 1,269,646 barrels in crude equivalent. The falling off of production, taken together with the increased demand which must result from the present reluctance of exporters, unite in warranting us in the belief above expressed, in enhanced prices for the coming year.

Our figures show a decrease in production for last month, compared with the preceding month, of 933 barrels per day, notwithstanding the number of wells drilled was slightly greater than in the preceding month. It will be noticed, too, that the average per well of the new wells for last month is a little less than that of the new wells for the month before; besides, it is generally recognized that the force of the gas in the region is gradually becoming less, and pumping is more commonly resorted to. As nearly as we can ascertain, about one-eighth of all the wheels of the Bradford region are now pumping. We believe, however, on the whole, judging the character of the Bradford producing field, that the falling off of production will be quite gradual. Our reason for this is that the Bradford field is essentially different from its predecessor—the Butler field. The wells in the Butler field were often close together, many of them were very large and fell off rapidly; while the wells of the Bradford region are smaller, farther apart, much greater in number, have a greater area from which to draw oil, and consequently decline very much more slowly. —*Stowell's Reporter.*

TOOL FOR DRIVING AND CLINCHING NAILS.

A novel method of making a nail hole and driving and clinching the nail is shown in the annexed engraving. The instrument for making the hole has a notched end which leaves a ridge in the center of the hole at the bottom. The nail driving tool consists of a socket provided with a suitable handle, and containing a follower which rests upon the



TOOL FOR DRIVING AND CLINCHING NAILS.

head of the nail to be driven, and receives the blows of the hammer in the operation of driving the nail. The nail is split for one half its length, and the two arms thus formed are slightly separated at the point, so that when they meet the ridge at the bottom of the hole they will be still further separated and will clinch in the body of the wood.

This invention was recently patented by Mr. Charles P. Ball, of Danville, Ky.

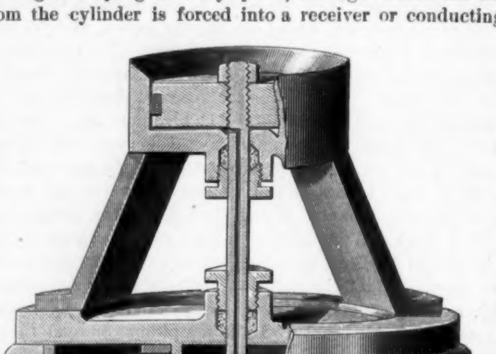
AUTOMATIC BALANCE ATTACHMENT FOR VALVES.

It is well known that in all air compressors and water pumps the pressure in cylinder of air compressors or in working barrel or cylinder of pumps is much greater at the point of opening the delivery valves than the actual pressure in the air receivers of compressors or in water column of pumps, because of the difference in area between the top and bottom of delivery valves. In some air compressors a hundred and twenty-five pounds pressure to the square inch is required in the cylinder to eighty pounds in the receiver, and in some instances a hundred pounds pressure is required in the cylinder to eighty pounds pressure in the receiver or column.

The engraving shows an invention designed to remedy this defect in air compressors and pumps, to provide a device which will enable the compressors and pumps to operate with equal pressure on both sides of the delivery valve.

The invention consists of an auxiliary valve arranged outside of the cylinder, where it is not subjected to back pressure, and connected with the delivery valve by a hollow valve stem.

In the engraving, which is a sectional view, the cylinder of an air compressor is represented, on the end of which there is a ring containing delivery ports, through which the air from the cylinder is forced into a receiver or conducting



AUTOMATIC BALANCE ATTACHMENT FOR DELIVERY VALVES OF AIR COMPRESSORS AND WATER PUMPS.

pipe. This ring is provided with an inner flange or valve seat on which rests the delivery valve. These parts are similar to those seen in some of the air compressors in common use, and with this construction and arrangement one hundred pounds pressure to the square inch in the cylinder is required to open the valve against eighty pounds pressure in the receiver or in the conducting pipes.

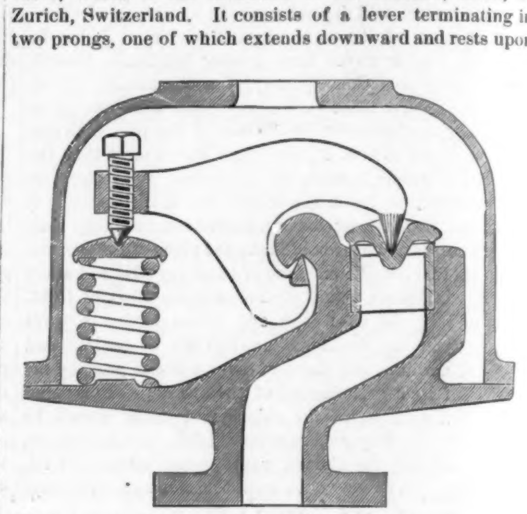
A drum having an open end is connected with the cylinder head by inclined standards, and contains a piston connected with the valve by means of a rod that extends centrally through the cylinder head. On the outer end of this rod is screwed an adjusting nut, by means of which the piston may be adjusted. This rod is bored longitudinally, establishing communication between the compressor cylinder and the drum containing the piston.

It will be seen that the upper face of the piston is exposed so as to be subjected to atmospheric pressure only, and when the compressor is in operation a portion of the air in the compressor cylinder passes through the hollow rod into the space beneath the piston, and there exerts sufficient pressure, in combination with the pressure on the inner face of the valve, to open the valve against an equal pressure in the receiver or conducting pipes, so that when the pressure in the cylinder equals the pressure in the receivers the valve is opened and held in place until the piston in the cylinder starts on the return stroke, when the pressure under the piston is immediately relieved through the hollow rod and the main valve closes.

The space between the valve and its seat is made as shallow as possible, so that the space may be quickly filled and exhausted. The piston may be adjusted to regulate this space. This invention was recently patented by Messrs. Samuel B. Connor and Henry Dods, of Virginia City, Nevada.

IMPROVED SAFETY VALVE.

In the annexed cut we have represented a steam safety valve, which is the invention of M. Schmidt, M.E., of Zurich, Switzerland. It consists of a lever terminating in two prongs, one of which extends downward and rests upon



IMPROVED SAFETY VALVE.

the cap, closing the top of the tube through which the steam escapes. The other prong extends upward and catches under a projection of the steam tube, and forms the fulcrum for the lever. The opposite end of this lever is provided with an adjustable screw pressing upon a plate that rests on the top of a spiral spring, which keeps the valve closed by pressing the outer end of the lever upward. As soon as the pressure of the steam overcomes the pressure of the spiral spring the valve will be raised, permitting the steam to escape. The apparatus is contained in a case having a central aperture for the escape of steam.

Raising Sunken Vessels.

An experiment recently took place in the East India Dock Basin, Blackwall, London, by permission of Mr. J. L. du Plat Taylor, the secretary of the Dock Company, for the purpose of testing and illustrating the mode of raising sunken ships by means of the apparatus patented by Mr. William Atkinson, naval engineer, of Sheffield. The machinery employed consists of the necessary number and size, according to the power required, of oval or egg-shaped buoys constructed of sheet iron, having an internal valve of a simple and effective character. Captain Hales Dutton, the dock master, who assisted during the operations, had placed his small yacht at the inventor's service for the occasion. The vessel was moored in the basin, and a set of four buoys were attached to it, one on each side near the bow and the stern. Air was supplied from a pump on the quay by a pipe communicating with a small copper globe resting on the deck of the vessel, and from which place proceeded four other flexible tubes, one to each buoy, thus distributing the air to each one equally. The vessel being flooded and in a sinking condition, the buoys were attached and the valves opened; they rapidly filled with water, and the vessel immediately sank in about 30 feet. Upon the first attempt an air chamber in the stern had been lost sight of, causing the vessel to come up to the surface stern uppermost; this being rectified, the vessel was again sent to the bottom, and allowed to remain a short time to allow her to settle down. When the order was given to work the pump, the vessel was brought to the surface, perfectly level, in about three minutes. The apparatus used, although only models, and on a comparatively diminutive scale (the buoys measuring 3 feet 4 inches in height and 2 feet 6 inches in diameter), was estimated to be capable of lifting a weight of nearly 20 tons, and that it needed, as represented by the patentee, only a corresponding increase in the lifting power to deal successfully with vessels of any tonnage.

NEW HAND POWER BAND SAW.

The engraving shows a new hand power band saw made by Frank & Co., of Buffalo, N. Y., and designed to be used in shops where there is no power and where a larger machine would be useless. It is calculated to meet the wants of a large class of mechanics, including carpenters and builders, cabinet makers, and wagon makers. It is capable of sawing stuff six inches thick, and has a clear space of thirty inches between the saw and the frame. The upper wheel is adjusted by a screw pressing against a rubber spring which compensates for the expansion and contraction of the saw.

The machine has a very complete device for raising, lowering, and adjusting the wheel, and all of the parts are made with a view to obtaining the best results in the simplest and most desirable way.

The machine is six feet wide and five feet high, and weighs 380 lb. The wheels are covered with pure rubber bands well cemented.

Further particulars may be obtained by addressing Messrs. Frank & Co., 176 Terrace street, Buffalo, N. Y.

HAND POWER BAND SAW.

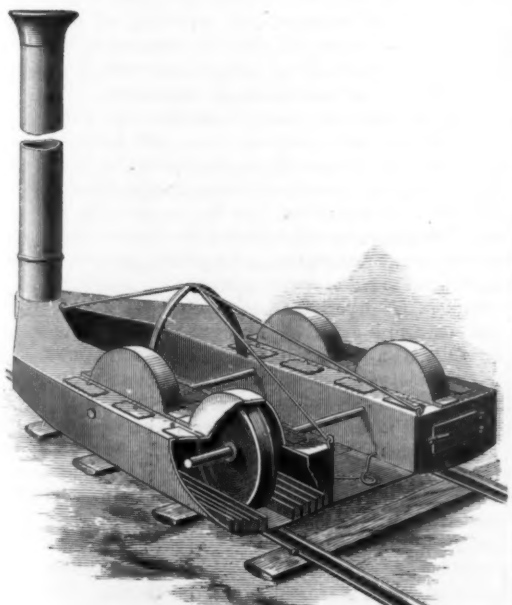
The Harbor of Montreal.

A plan for the improvement of the harbor of Montreal, Canada, has been submitted to the City Board of Trade by James Shearer, a well known citizen. Mr. Shearer's plan is to divert the current of the St. Lawrence opposite the city into the channels between St. Helen's Island and the southern shore, and by having various obstructions removed from the channel, and running a dam, or "peninsula," as he calls it, built from Point St. Charles, in the west end of the city, to St. Helen's Island, midway in the river, thus stopping the current from running through the present main channel between the city and St. Helen's Island.

Among the practical advantages that will accrue to the city and harbor from the carrying out of this project, Mr. Shearer sets forth the following: The dam will prevent the shoring of ice opposite the city, and the consequent flooding of the Griffintown district, which is annually very destructive to property, and will make a still harbor, where vessels may lie during the winter. It is estimated that the construction of the dam, which would be 2,700 feet long and 900 feet broad, would raise the water two feet in the river and lower it ten feet in the harbor. This would give a head of twenty-five feet for mills, elevators, and factories, and the transportation of freight. The dam would afford a roadway across the river, upon the construction of a bridge from St. Helen's Island to St. Lambert, thus removing the necessity of a tunnel. The roadway could be utilized for a railway, a road for carriages and foot passengers. The estimated cost of the improvement is $7,000,000.

APPARATUS FOR REMOVING ICE FROM RAILROADS.

The engraving shows an improved apparatus for removing snow and ice from railroads and streets by means of heat. The invention consists of a double furnace mounted on wheels, which are incased in the fire boxes of the furnace, so that in use the entire apparatus, including the wheels, will become highly heated, so that the snow and ice will not only be melted by radiant heat, but by the actual contact of the hot surfaces of the furnace and wheels. This apparatus was recently patented by the late E. H. Anganuar, of New Orleans, La.



APPARATUS FOR REMOVING ICE FROM RAILROADS.

Ericsson's New Submarine Gun.

The protracted trials conducted on board the Destroyer to test its submarine gun terminated last week. Having, says the *Army and Navy Journal*, in a previous issue described this novel type of naval artillery, it will suffice to remind our readers that its caliber is 16 inches, length of bore 30 feet, and that it is placed at the bottom of the vessel, the muzzle passing through an opening formed in the wrought iron stem.

We have hitherto, in discussing the properties of the Destroyer, referred to its offensive weapon as a "torpedo," a term not altogether inappropriate while it was actuated by compressed air. But Capt. Ericsson having in the meantime wholly abolished compressed air in his new system of naval attack, substituting guns and gunpowder as the means of producing motive energy, it will be proper to adopt the constructor's term, *projectile*. It will not surprise those who are acquainted with the laws of hydrostatics and the enormous resistance offered to bodies moving swiftly through water, that the determination of the proper form of projectile for the submarine gun has demanded protracted experiments, commencing at the beginning of June and continued up to last week, as before stated. The greater portion of these experiments, it should be observed, has been carried out with a gun 30 feet long, 15 inches caliber—not a breech-loader, however, as in the Destroyer, but a muzzle-loader, suspended under the bottom of two wrecking scows, the gun being lifted above the water, after each shot, by shears and suitable tackle. The present projectile of the Destroyer is the result of the extended trials referred to; its length is 25 feet 6 inches, diameter 16 inches, and its weight 1,500 pounds, including 250 pounds of explosive materials. We are not at liberty at present to describe its form, but we may mention that the great length of the body and the absence of all internal machinery enable the constructor to carry the stated enormous quantity of explosive matter. With minimum charge of powder in the chamber of the gun, the speed attained by the projectile reaches 310 feet in the first three seconds.

The question may be asked, in view of these facts, whether the boasted costly steam ram is not superseded by the cheap aggressive system represented by the Destroyer. Evidently the most powerful of the English steam rams could not destroy an armored ship as effectually as the projectile from the submarine gun, the explosion of which is capable of shattering any naval structure.

It should be borne in mind, also, that being protected by heavy inclined transverse armor, the Destroyer, attacking bows on, can defy ordnance of all calibers. Again, the carrier of the submarine gun, in addition to the swiftness of its projectile, can outrun ironclad ships.

RECENT INVENTIONS.

Mr. Francis M. Osborn, of Port Chester, N. Y., has patented a covering for a horse that protects him from the weather and from chafing. The blanket has a band, also stays and straps, the use of which does away with the surcingle and affords a most efficient protection for the horse, and may be easily worn under harness in wet weather or at other times, when desirable.

A novel device, designed especially for containing boxes of cigars and protecting and displaying their contents, has been patented by Mr. Robert B. Dando, of Alta, Iowa. The invention consists of a case containing shelves, on which are fixed the covered cigar or other boxes, cords connecting the box lids and case doors, so that the opening of the case doors causes the box lids to open.

An improved bottle stopper has been patented by Mr. Andrew Walker, of Cincinnati, O. The invention consists in combining with the stopper caps connected by an intermediate spring.

Mr. James B. Law, of Darlington Court House, S. C., has patented an improved construction of buckle for fastening the ends of cotton and other bale bands; it consists in a buckle having a permanent seat for one end of the bale band, a central opening, into which the other end of the band is entered through an oblique channel, and a bar offsetting from the plane of the buckle, notched or recessed to prevent lateral movement of the band, and connecting the free ends of the buckle on each side of the oblique channel to strengthen the buckle.

An improved buckboard wagon has been patented by Mr. William Sanford, of Cohoes, N. Y. The invention consists in combining with the buckboards curved longitudinal springs placed beneath the buckboards, and curved cross springs connected at their ends with the buckboards by cap plates so as to increase the strength and elasticity of the wagon.

An improved vehicle wheel has been patented by Messrs. George W. Dudley and William J. Jones, of Waynesborough, Va. The main object of this invention is to form a wheel hub for vehicles in such manner that the wheel will yield sufficiently when undue and sudden strains or jars may come upon it to receive the force of the blow and shield the other portions of the vehicle from the destructive effects of such action, as well as to afford ease and comfort of motion to the occupant; and the improvement consists in securing the inner ends of the spokes to rim plates, to form a fixed and solid connection therewith, the rim plates being loosely secured to the butt flanges and box of the hub, so that it is free to move in a vertical plane, but prevented from moving laterally and limited in its vertical movement by an elastic packing interposed between the inner ends of the spokes and the hub box.

Mr. Francis G. Powers, of Moweaqua, Ill., has patented an improvement in the class of atmospheric clothes pounders, that is to say, pounders, which are constructed with one or more chambers or cavities in which the air is alternately compressed and allowed to expand at each reciprocation.

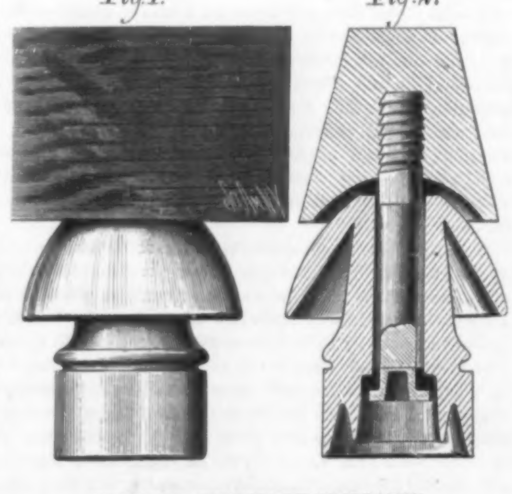
An improved means for connecting the body of a baby carriage to the running gear has been patented by Mr. Charles M. Hubbard, of Columbus, Ohio. It consists in supporting the rear end by one or more coil springs, and hinging the front portion of the body to a pair of upturned supports rising from the front axle.

An improved ferrule for awl handles has been patented by Mr. Jules Steinmeyer, of St. Louis, Mo. The object of this invention is to prevent splitting of the handle, to secure both the ferrule and leather pad firmly in place, and to furnish a durable and serviceable awl handle.

NEW TELEGRAPH INSULATOR.

The insulator represented in the annexed engraving was originally designed to meet the requirements of South American telegraph service, but it is equally well adapted to lines in other places. The main idea is to avoid breakage from expansion and contraction in a climate subject to sudden changes of temperature, and to avoid the mischief occasioned by a well known South American bird, the "hornero," by building nests of mud on the brackets and insulators. With this insulator these nests cannot cause a weather contact or earth; on the contrary, the nest rather improves the insulation. The sectional view, Fig. 2, shows the construction of the insulator and the manner of fastening it to the cross arm or bracket. A rubber ring is placed between the upper end of the porcelain insulator and the cross arm, and another similar ring is placed between the head of the suspending screw and the bottom of the insulator. It will be noticed that with this construction the insulator cannot be broken by the contraction of the screw or by the swelling of the cross-piece. This insulator can be used on an iron bracket and in connection with either iron or wooden posts, and is in every way more secure than the insulators in common use. The first cost of these insulators compares favorably with the cheapest in market, while it is less liable to breakage, lasts longer, and gives better results. It has been patented in this country and in Europe.

Fig.1. Fig.2.



IMPROVED TELEGRAPH INSULATOR.

Further information may be obtained by addressing Mr. J. H. Bloomfield, Concordia, Entre Reos, Argentine Republic, South America.

BUSINESS COLLEGES.

PACKARD'S BUSINESS COLLEGE.

There are two very general prejudices against the class of schools known as business colleges. One is that their chief aim—next to lining the pockets of their proprietors—is to turn out candidates for petty clerkships, when the country is already overrun with young men whose main ambition is to stand at a desk and "keep books." The other is that the practical outcome of these institutions is a swarm of conceited flourishers with the pen, who, because they have copied a set or two of model account books and learned to imitate more or less cleverly certain illegibly artistic writing copies, imagine themselves competent for any business post, and worthy of a much higher salary than any merely practical accountant who has never been to a business college or attempted the art of fancy penmanship as exhibited in spread eagles and impossible swans.

As a rule popular prejudices are not wholly unfounded in reason; and we should not feel disposed to make an exception in this case. When the demand arose for a more practical schooling than the old-fashioned schools afforded, no end of writing-masters, utterly ignorant of actual business life and methods, hastened to set up ill-managed writing schools which they dubbed "business colleges," and by dint of advertising succeeded in calling in a multitude of aspirants for clerkships. In view of the speedy discomfiture of the deluded graduates of such schools when brought face to face with actual business affairs, and the disgust of their employers who had engaged them on the strength of their alleged business training, one is not so much surprised that prejudice against business colleges still prevails in many quarters, as that the relatively few genuine institutions should have been able to gain any creditable footing at all.

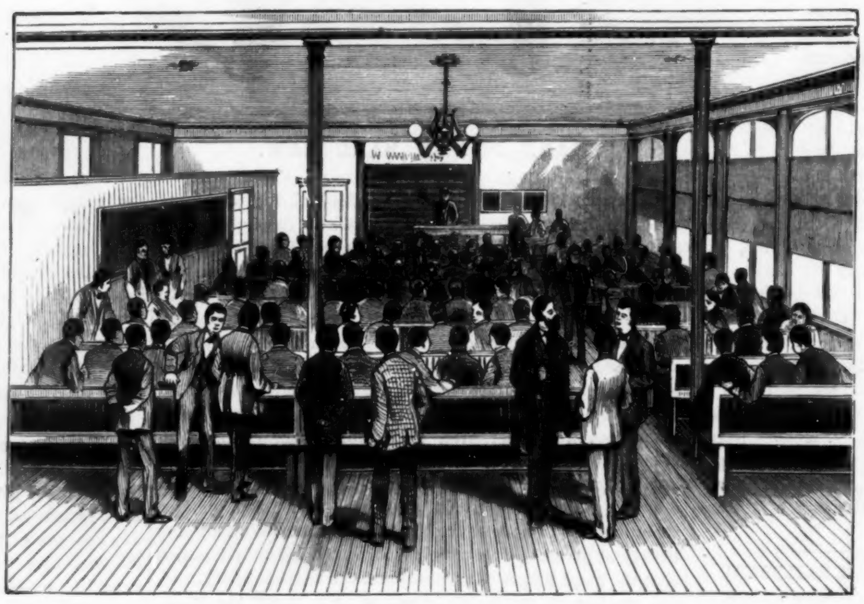
The single fact that they have overcome the opprobrium cast upon their name by quacks, so far as to maintain themselves in useful prosperity, winning a permanent and honorable place among the progressive educational institutions of the day, is proof enough that they have a mission to fulfill and are fulfilling it. This, however, is not simply, as many suppose, in training young men and young women to be skilled accountants—a calling of no mean scope and importance in itself—but more particularly in furnishing young people, destined for all sorts of callings, with that practical knowledge of business affairs which every man or woman of means has constant need of in every-day life. Thus the true business college performs a twofold function. As a technical school it trains its students for a specific occupation, that of the accountant; at the same time it supplements the education not only of the intending merchant, but equally of the mechanic, the man of leisure, the manufacturer, the farmer, the professional man—in short, of any one who expects to mix with or play any considerable part in the affairs of men. The mechanic who aspires to be the master of a successful shop of his own, or foreman or manager in the factory of another, will have constant need of the business habits and the knowledge of business methods and operations which a properly conducted business school will give him. The same is true of the manufacturer, whose complicated, and it may be extensive, business relations with the producers and dealers who supply him with raw material, with the workmen who convert such material into finished wares, with the merchants or agents who market the products of his factory, all require his oversight and direction. Indeed, whoever aspires to something better than a hand-to-mouth struggle with poverty, whether as mechanic, farmer, professional man, or what not, must of necessity be to some degree a business man; and in every position in life business training and a practical knowledge of financial affairs are potent factors in securing success.

How different, for example, would have been the history of our great inventors had they all possessed that knowledge of business affairs which would have enabled them to put their inventions in a business-like way before the world, or before the capitalists whose assistance they wished to invoke. The history of invention is full of illustrations of men who have starved with valuable patents standing in their names—patents which have proved the basis of large fortunes to those who were competent to develop the wealth that was in them. How often, too, do we see capable and ingenious and skillful mechanics confined through life to a small shop, or to a subordinate position in a large shop, solely through their inability to manage the affairs of a larger business. On the other hand, it is no uncommon thing to see what might be a profitable business—which has been fairly thrust upon a lucky inventor or manufacturer by the urgency of popular needs—fail disastrously through ignorance of business methods and inability to conduct properly the larger affairs which fell to the owner's hand.

Of course a business training is not the only condition of success in life. Many have it and fail; others begin without it and succeed, gaining a working knowledge of business affairs through the exigencies of their own increasing business needs. Nevertheless, in whatever line in life a man's course may fall, a practical business training will be no hinderance to him, while the lack of it may be a serious hinderance. The school of experience is by no means to be despised. To many it is the only school available. But unhappily its teachings are apt to come too late, and often they are fatally expensive. Whoever can attain the needed knowledge in a quicker and cheaper way will obviously do well so to obtain it; and the supplying of such practical knowledge, and the training which may largely take the place of experience in actual business, is the proper function of the true business college.

Our purpose in this writing, however, was not so much to enlarge upon the utility of business colleges, properly so called, as to describe the practical working of a representative institution, choosing for the purpose Packard's Business College in this city.

This school was established in 1858, under the name of Bryant, Stratton & Packard's Mercantile College, by Mr. S. S. Packard, the present proprietor. It formed the New York link in the chain of institutions known as the Bryant & Stratton chain of business colleges, which ultimately embraced fifty co-working schools in the principal cities of the United States and Canada. In 1867 Mr. Packard purchased the Bryant & Stratton interest in the New York College, and changed its name to Packard's Business College, retaining the good will and all the co-operative advantages of the Bryant & Stratton association. The original purpose of the college, as its name implies, was the education of young men for business pursuits. The experience of over twenty years has led to many improvements in the working of the school, and to a considerable enlargement of its scope and constituency, which now includes adults as well as boys, especial opportunities being offered to mature men who want particular instruction in arithmetic, bookkeeping, penmanship, correspondence, and the like.



LECTURE AND RECITATION ROOM.

The teachers employed in the college are chosen for their practical as well as their theoretical knowledge of business affairs, and every effort is made to secure timeliness and accuracy in their teachings. Constant intercourse is kept up with the departments at Washington as to facts and changes in financial matters, and also with prominent business houses in this and other cities. Among the recent letters received in correspondence of this sort are letters from the Secretary of State of every State in the Union with regard to rates of interest and usury laws, and letters from each of our city banks as to methods of reckoning time on paper, the basis of interest calculations, the practices concerning deposit balances, and other business matters subject to change. The aim of the proprietor is to keep the school abreast of the demands of the business world, and to omit nothing, either in his methods or their enforcement, necessary to carry out his purpose honestly and completely. An idea of the superior housing of the college will be obtained from the views of half a dozen of the rooms at No. 805 Broadway, as shown in this issue of the SCIENTIFIC AMERICAN—the finest, largest, most compact, and convenient suite of rooms anywhere used for this purpose.

The college is open for students ten months of the year, five days each week, from half past nine in the morning until half past two in the afternoon. Students can enter at any time with equal advantage, the instruction being for the most part individual. The course of study can be completed in about a year. The proprietor holds that with this amount of study a boy of seventeen should be able—

1. To take a position as assistant bookkeeper in almost any kind of business; 2. To do the ordinary correspondence of a business house, so far as good writing, correct spelling, grammatical construction, and mechanical requisites are concerned; 3. To do the work of an entry clerk or cashier; 4. To place himself in the direct line of promotion to any desirable place in business or life, with the certainty of holding his own at every step.

In this the student will have the advantage over the uneducated clerk of the same age and equal worth and capacity, in that he will understand more or less practically as well as theoretically the duties of those above him, and will thus be able to advance to more responsible positions as rapidly as his years and maturity may justify. It is obvious that the knowledge which makes an expert accountant will in all probability suffice for the general business requirements of professional men, the inheritors of property and business, manufacturers, mechanics, and others to whom bookkeeping and other business arts are useful aids, but not the basis of a trade. For the last-named classes, and for women, shorter periods of study are provided, and may be made productive of good results.

A sufficient idea of the general working of the college may be obtained by following a student through the several departments. After the preliminary examination a student who is to take the regular course of study enters the initiatory room. Here he begins with the rudiments of bookkeeping, the study which marks his gradation. The time not given to the practice of writing, and to recitations in other subjects, is devoted to the study of accounts. He is required, first, to write up in "skeleton" form—that is, to place the dates and amounts of the several transactions under the proper ledger titles—six separate sets of books, or the record of six different business ventures, wherein are exhibited as great a variety of operations as possible, with varying results of gains and losses, and the adjustment thereof in the partners' accounts, or in the account of the sole proprietor. After getting the results in this informal way—which is done in order as quickly as possible to get the theory of bookkeeping impressed upon his mind—he is required to go over the work again carefully, writing up with neatness and precision all the principal and auxiliary books, with the documents which should accompany the transactions, such as notes, drafts, checks, receipts, invoices, letters, etc. The work in this department will occupy an industrious and intelligent student from four to six weeks, depending upon his quickness of perception and his working qualities. While progressing in his bookkeeping, he is pursuing the collateral studies, a certain attainment in which is essential to promotion, especially correcting any marked deficiency in spelling, arithmetic, and the use of language.

Upon a satisfactory examination the student now passes to the second department, where a wider scope of knowledge in accounts is opened to him, with a large amount of practical detail familiarizing him with the actual operations of business. The greatest care is taken to prevent mere copying and to throw the student upon his own resources, by obliging him to correct his own blunders, and to work out his own results; accepting nothing as final that has not the characteristics of real business. Much care is bestowed in this department upon the form and essential matter of business paper, and especially of correspondence. A great variety of letters is required to be written on assigned topics and in connection with the business which is recorded, and thorough instruction is given in the law of negotiable paper, contracts, etc. During all this time the student devotes from half an hour to an hour daily to penmanship, a plain, practical, legible hand being aimed at, to the exclusion of superfluous lines and flourishes. It is expected that the work in the first and second departments will establish the student in the main principles of bookkeeping, in its general theories, and their application to ordinary transactions.

In the third department the student takes an advanced position, and is expected, during the two or three months he will remain in this department, to perfect himself in the more subtle questions involved in accounts, as well as to shake off the crude belongings of schoolboy work. He will be required to use his mind in everything he does—to depend as much as possible upon himself. The work which he presents for approval here must have the characteristics of business. His letters, statements, and papers of all kinds are critically examined, and approved only when giving evidence of conscientious work, as well as coming up to strict business requirements. Before he leaves this department he should be versed in all the theories of accounts; should write an acceptable business hand; should be able to execute a faultless letter so far as relates to form, spelling, and grammatical construction, should have a fair knowledge of commercial law, and have completed his arithmetical course.

The next step is to reduce the student's theoretical knowledge to practice, in a department devoted to actual business operations. This business or finishing department is shown at the upper left corner of our front page illustration. The work in this department is as exacting and as real as the work in the best business houses and banks. At the extreme end of the room is a bank in complete operation, as perfect in its functions as any bank in this city or elsewhere. The records made in its books come from the

real transactions of dealers who are engaged in different lines of business at their desks and in the offices. The small office adjoining the bank, on the right, is a post office, the only one in the country, perhaps, where true civil service rules are strictly observed. In connection with it is a transportation office. From fifty to a hundred letters daily are received and delivered by the post office, written by or to the students of this department.

The correspondence thus indicated goes on not only between the students of this college, but between members of this and other similar institutions in different parts of the country. A perfected system of intercommunication has for years been in practice between co-ordinate schools in New York, Boston, Brooklyn, Philadelphia, Chicago, Baltimore, and other cities, by which is carried on an elaborate scheme of interchangeable business, little less real in its operations and results than the more tangible and obtrusive activity which the world recognizes as business.

The work of the transportation office corresponds with that of the post office in its simulation of reality. The alleged articles handled are represented by packages bearing all the characteristic marks of freight and express packages. They are sent by mail to the transportation company, and by this agency delivered to the proper parties, from whom the charges are collected in due form, and the requisite vouchers passed. Whatever is necessary in the way of manipulation to secure the record on either hand is done, and, so far as the clerical duties are concerned, there is no difference between handling pieces of paper which represent merchandise and handling the real article.

In the bank is employed a regular working force, such as may be found in any bank, consisting of a collector or runner, a discount clerk, a deposit bookkeeper, a general bookkeeper, and a cashier. The books are of the regular form, and the work is divided as in most banks of medium size, and the business that is presented differs in no important particular from that which comes to ordinary banks. After getting a fair knowledge of theory, the student is placed in this bank. He begins in the lowest place, and works up gradually to the highest, remaining long enough in each position to acquaint himself with its duties. He is made familiar with the form and purpose of all kinds of business paper, and the rules which govern a bank's dealings with its customers. He gets a practical knowledge of the law of indorsement and of negotiability generally, and is called upon to decide important questions which arise between the bank and its dealers. Wherever he finds himself at fault he has access to a teacher whose duty it is to give the information for which he asks, and who is competent to do it.

Throughout the whole of this course of study and practice the students are treated like men and are expected to behave like men.

The college thus becomes a self-regulating community, in which the students learn not only to govern themselves, but to direct and control others. As one is advanced in position his responsibilities are increased. He is first a merchant or agent, directing his own work; next, a sub-manager, and finally manager in a general office or the bank, with clerks subject to his direction and criticism, until he arrives at the exalted position of "superintendent of offices," which gives him virtual control of the department. This is, in fact, an important part of his training, and the reasonable effect of the system is that the student, being subject to orders from those above him, and remembering that he will shortly require a like consideration from those below him, concludes that he cannot do a better thing for his own future comfort than to set a wholesome example of subordination.

This, however, is not the only element of personal discipline that the college affords. At every step the student's conduct, character, and progress are noted, recorded, and securely kept for the teacher's inspection, as well as that of his parents and himself. Such records are kept in the budget room, shown in the lower left corner of the front page.

This budget system was suggested by the difficulties encountered in explaining to parents the progress and standing of their sons. The inconvenience of summoning teachers, and of taking students from their work, made necessary some simpler and more effective plan. The first thing required of a new student is that he should give some account of himself, and to submit to such examinations and tests as will acquaint his teachers with his status. This account and these tests constitute the subject-matter of his first budget, which is placed at the bottom of his box, and every four weeks thereafter, while he remains in the school, he is required to present the results of his work, such as his written examinations in the various studies, his test examples in arithmetic, his French, German, and Spanish translations and exercises, various letters and forms, with four weekly specimens of improvement in writing, the whole to be formally submitted to the principal in an accompanying letter; the letter itself to exhibit what can be thus shown of improvement in writing, expression, and general knowledge. These budgets, accumulating month by month, are made to cover as much as possible of the student's school work, and to constitute the visible steps of his progress.

Besides this is a character record, kept in a small book assigned to each student, every student having free access to his own record, but not to that of any fellow student. Each book contains the record of a student's deportment from the first to the last day of his attendance, with such comments and recommendations as his several teachers may think likely to be of encouragement or caution to him.

In addition to the strictly technical training furnished by the college, there is given also not a little collateral instruction calculated to be of practical use to business men. For example, after roll call every morning some little time is spent in exercises designed to cultivate the art of intelligent expression of ideas. Each day a number of students are appointed to report orally, in the assembly room, upon such matters or events mentioned in the previous day's newspapers as may strike the speaker as interesting or important. Or the student may describe his personal observation of any event, invention, manufacture, or what not; or report upon the condition, history, or prospects of any art, trade, or business undertaking. This not to teach elocution, but to train the student to think while standing, and to express himself in a straightforward, manly way.

Instruction is also given in the languages likely to be required in business intercourse or correspondence; in phonography, so far as it may be required for business purposes; commercial law relative to contracts, negotiable paper, agencies, partnerships, insurance, and other business proceedings and relations; political economy, and incidentally any and every topic a knowledge of which may be of practical use to business men.

In all this the ultimate end and aim of the instruction offered are practical workable results. Mr. Packard regards education as a tool. If the tool has no edge, is not adapted to its purpose, is not practically usable, it is worthless as a tool. This idea is kept prominent in all the work of the college, and its general results justify the position thus taken. The graduates are not turned out as finished business men, but as young men well started on the road toward that end. As Mr. Packard puts it: "Their diplomas do not recommend them as bank cashiers or presidents, or as managers of large or small enterprises, but simply as having a knowledge of the duties of accountantship. They rarely fail to fulfill reasonable expectations; and they are not responsible for unreasonable ones."

American Institute of Architects.

The fourteenth annual convention of the American Institute of Architects began in Philadelphia, November 17. Mr. Thomas U. Walter, of Philadelphia, presided, and fifty or more prominent architects were present. In his annual address the president spoke of the tendency of the architectural world as decidedly in the direction of originality. But little attention is paid to the types of building drawn from the works of by-gone ages or to the mannerisms of the more recent past. Progress in the development of the elements of taste and beauty, and the concretion of æsthetic principles with common sense in architectural design, are now everywhere apparent. The responsibilities of architects are greater than they have ever before been; the growing demand of the times calls for intelligent studies in all that relates to architecture, whether it be in the realm of æsthetics, in sciences that relate to construction, in the nature and properties of the materials used, in the atmosphere that surrounds us, or in the availability of the thousand-and-one useful and ingenious inventions that tend to promote the convenience and completeness of structures.

Papers were read by Mr. A. J. Blood, of New York, on "The Best Method of Solving the Tenement House Problem;" Mr. George T. Mason, Jr., of Newport, on "The Practice of American Architects during the Colonial Period;" Mr. Robert Briggs, of Philadelphia, on "The Ventilation of Audience Rooms;" Mr. T. M. Clark, of Boston, on "French Building Laws, etc."

The following named officers were elected: President, T. U. Walter, Philadelphia; Treasurer, O. P. Hatfield, New York; Secretary, A. J. Blood. Trustees, R. M. Hunt, H. M. Congdon, J. Cady, Napoleon Le Brun, New York. Committee on Publication, R. M. Upjohn, New York; T. M. Clark, Boston; John McArthur, Jr., Philadelphia; A. J. Blood, H. M. Congdon, New York. Committee on Education, W. R. Narr, Boston; Russell Sturgis, New York; N. Clifford Ricker, Champagne, Ill.; Henry Van Brunt, Boston; Alfred Stone, Providence. Corresponding Secretary, T. M. Clark, Boston.

The time and place of the next annual convention were left to the Board of Trustees, with a request that Washington be selected.

Vennor's Winter Predictions.

He communicates as follows to the Albany *Argus*: "December will, in all probability, open with little snow, but the weather will be cloudy, threatening snow falls. During the opening days of the month, dust, with the very light mixture of snow which may have fallen, will be swept in flurries by the gusty wind. There will probably be some snow from about the 4th of the month. With the second quarter of the month colder weather will probably set in with falls of snow. The farmers will be able to enjoy sleigh rides in the cold, exhilarating air, but good sleighing need not be expected until after the middle of the month. There will be a spell of mild weather about the 13th and 14th. After a brief interval of mild weather, during which more snow will fall, the third quarter of the month will probably see blustering and cold weather—a cold snap with heavy snow storms and consequent good sleighing. Very cold weather may be expected during this quarter. The last quarter of the month will bring milder weather, but will terminate, probably, with heavy snow-falls and stormy weather; in fact, the heaviest snow falls will be toward the end of the month, and snow blockades may be looked for, the snow falls extending far to the southward, possibly as far as Washington, with very stormy weather around New York and Boston." Mr. Vennor's latest predictions are that the coming month will be "decidedly cold, with tremendous snow-falls during the latter half and early part of January, causing destructive blockades to railroads."

The London Underground Railway.

The opening recently of the extension of the Metropolitan Railway to Harrow, and the early commencement of another of the lines of the company, give especial prominence to it. The Metropolitan Underground Railway is emphatically the great passenger railway of the country, for its few miles of line carry more than the hundreds of miles of line of companies such as the London and North-Western or Great Western. Seventeen years ago—in 1863—the Metropolitan carried less than 10,000,000 passengers, and in the full year's work of the following twelve months it carried less than 12,000,000. But year by year, almost without exception, the number of passengers has grown. In 1865, over 15,000,000 passengers were carried; in 1867, over 23,000,000; and in 1870, over 39,000,000 passengers traveled on the line. The years that have since passed have swollen that number. In 1872, over 44,300,000 were carried, but in the following year there was one of the few checks, and not till 1875 was the number of 1872 exceeded. In 1875 it rose to 48,302,000; in 1877 it had advanced to 56,175,000; in 1878 to 58,807,000; and in 1879 to 60,747,000. In the present year there has been a further advance, the number carried for the first six months of the present year being 31,592,429. When it is borne in mind that this is equal to 7,272 passengers every hour, and that the length of line worked by the company's engines, including that of the "foreign" line worked, is slightly less than 25 miles, the fecundity in traffic of the metropolitan district must be said to be marvelous. It is to be regretted that the official account from which these figures are given does not give any idea of the number of passengers in the different classes, for such a return would be of value. It is a marvelous fact in the history of locomotion that this great passenger traffic is worked with not more than 58 engines, while the total number of carriages, 195, is in comparison with the number of travelers in them a marvel in railway history. But it is tolerably clear that there is yet a vast amount of undeveloped metropolitan traffic, and it is also certain that as that traffic is developed the future of the Metropolitan as it attains more completeness will be brighter even than it has been in the past. The great city is more and more the mart of the world, and the traffic and travel to and in it must increase. That increase will be shared in considerable degree by the "underground" companies, and as they have shown that their capabilities of traffic are almost boundless, it may be expected that the oldest and the chief of these will in the early future know a growth as continuous if less rapid than in the past.

We take the above from the *Engineer*, London. In this city there are now existing 27 miles of elevated steam railways for local passenger traffic. These roads have carried during the past year 61,000,000 of passengers. In this service they employ 175 locomotives and 500 passenger cars. It is a terrible nuisance to have these locomotives and cars constantly whizzing through the public streets; still the roads are a great accommodation. The only underground railway in this city is that of the New York Central and Hudson River, 4 miles in length, extending under Fourth avenue from Forty-second street to Harlem River. Over this road the enormous traffic of the Central, Harlem, and the New Haven roads, with their connections, passes. But so removed from public sight are the cars and locomotives that the existence of this underground railway is almost forgotten.

Tempering Chisels.

A practical mechanic communicates to the SCIENTIFIC AMERICAN the following: In hardening and tempering a cold chisel care should be taken to have a gradual shading of temper. If there is a distinct boundary line of temper color between the hard cutting edge and softer shank portion, it will be very apt to break at or near that line. The cutting edge portion of the chisel should be supported by a backing of steel gradually diminishing in hardness; and so with all metal cutting tools that are subjected to heavy strain. Not every workman becomes uniformly successful in this direction, for, in addition to dexterity, it requires a nice perception of degree of heat and of color in order to obtain the best result.

MR. A. A. KNUDSON, of Brooklyn, N. Y., has lately perfected and patented a system of protecting oil tanks from lightning, which is approved by several prominent electricians. The invention includes a device for distributing a spray of water over the top of the tank for condensing the rising vapor and cooling the tank; a system of lightning conductors connected with a gutter surrounding the tank, and a hollow earth terminal connected with the gutter by a pipe, and designed to moisten the earth, and at the same time prevent the earth around the terminal from becoming saturated with oil.

A CORRESPONDENT of the *Christian Union*, writing from Constantinople, says that Abd-ul-Hamid, the Sultan of Turkey, reads the SCIENTIFIC AMERICAN, the engravings in which seem to specially interest him. The writer adds that whatever in literature the Sultan may chance to hear of which he thinks may interest him, he has translated into Turkish.

AMATEUR MECHANICS.

A SIMPLE SINGLE-ACTING STEAM ENGINE.

The great bugbear staring the amateur mechanic in the face when he contemplates making a small steam engine is the matter of boring the cylinder. To bore an iron cylinder on a foot lathe is difficult even when the lathe is provided with automatic feed gear, and it is almost impossible with the ordinary light lathe possessed by most amateurs. To bore a brass cylinder is easier, but even this is difficult, and the cylinder, when done, is unsatisfactory on account of the difficulty of adapting a durable piston to it.

The engravings show a simple steam engine, which requires no difficult lathe work; in fact the whole of the work may be done on a very ordinary foot lathe. The engine is necessarily single-acting, but it is effective nevertheless, being about 1-20 H. P., with suitable steam supply. It is of sufficient size to run a foot lathe, scroll saw, or two or three sewing machines.

The cylinder and piston are made from mandrel drawn brass tubing, which may be purchased in any desired quantity in New York city. The fittings are mostly of brass, that being an easy metal to work.

The principal dimensions of the engine are as follows:

Cylinder.—Internal diameter, 1⅛ in.; thickness, ⅛ in.; length, 3⅝ in.

Piston.—External diameter, 1⅛ in.; thickness, 3-32 in.; length, 3⅞ in.

Length of stroke, 2 in.

Crank pin.—Diameter, ¼ in.; length of bearing surface, ⅛ in.

Connecting rod.—Diameter, 5 16 in.; length between centers, 5½ in.

Shaft.—Diameter, ⅝ in.; diameter of bearings, ½ in.; length, 6 in.; distance from bed to center of shaft, 1½ in.

Flywheel.—Diameter, 8 in.; weight, 10 lb.

Valve.—Diameter of chamber, 9-16 in.; length, 1¼ in.; width of valve face working over supply port, 3 32 in.; width of space under valve, ⅜ in.; length of the same, 1 in.; distance from center of valve spindle to center of eccentric rod pin, ¾ in.

Ports, supply.—Width, 1-16 inch.; length, 1 in. Exhaust.—Width, ⅛ in.; length, 1 in; space between ports, 5-16 in.

Pipes.—Steam supply, ¼ in.; exhaust, ⅜ in.

Eccentric.—Stroke, ⅝ in.; diameter, 1 5-16 in. angle; length of eccentric rod between centers, 8⅝ in.

Cut-off, ⅝

Thickness of base plate, ¼ in.

Wooden base, 6¼ in x 8 in.; 2⅝ in. thick.

Thickness of plate supporting cylinder, ⅜ in.

Total height of engine, 13¼ in.

Distance from base plate to under side of cylinder head, 9¼ in.

Diameter of vertical posts, 9-16 in.; distance apart, 3½ in.; length between shoulders, 6¼ in.

Base plate fastened to base with ¼ in. bolts.

The connecting rod, eccentric rod, crank pin, and shaft, are of steel. The eccentric-strap and flywheel are cast iron, and the other portions of the engine are of brass. The screw threads are all chased, and the flange, *a*, and head of the piston, F, in addition to being screwed, are further secured by soft solder.

Fig. 1 shows the engine in perspective. Fig 2 is a side elevation, with parts broken away. Fig. 3 is a vertical transverse section. Fig. 4 is a partial plan view. Fig. 5 is a detail view of the upper end of the connecting rod and its connections; and Fig. 6 is a horizontal section taken through the middle of the valve chamber.

The cylinder, A, is threaded externally for 1 inch from its lower end, and the collar, *a*, ¼ inch thick, is screwed on and soldered. The face of the collar is afterward turned true. The same thread answers for the nut which clamps the cylinder in the plate, B, and for the gland, *b*, of the stuffing box, which screws over the beveled end of the cylinder, and contains fibrous packing filled with asbestos or graphite. The posts, C, are shouldered at the ends and secured in their places by nuts. Their bearing surface on the plate, D, is increased by the addition of a collar screwed on. The posts are made from drawn rods of brass, and need no turning except at the ends.

The cylinder head, E, which is a casting containing the valve chamber, is screwed in. The piston, F, fits the cylinder closely, but not necessarily steam tight. The head is screwed in and soldered, and the yoke, G, which receives the connecting rod pin, is screwed into the head. The connecting rod, H, is of steel with brass ends. The lower end, which receives the crank pin, is split, and provided with a tangent screw for taking up wear. The crank pin is secured in the crank disk, I, by a nut on the back. The eccentric rod, J, is of steel, screwed at its lower end into an eccentric strap of cast or wrought iron, which surrounds the eccentric, K.

The valve, L, is slotted in the back to receive the valve spindle, by which it is oscillated. The ports are formed by drilling from the outside, and afterward forming the slot with a graver or small sharp chisel. The supply port, for convenience, may be somewhat enlarged below. The holes for the exhaust port will be drilled through the hole into which the exhaust pipe is screwed. The chamber communicating with the exhaust is cored out in the casting.

The easiest way to make the valve is to cut it out of a solid cylinder turned to fit the valve chamber.

An engine of this kind will work well under a steam pressure of 50 lb., and it may be run at the rate of 200 to 250 revolutions per minute.

It is desirable to construct a flat pasteboard model to verify measurements and to get the proper adjustment of the valve before beginning the engine. M.

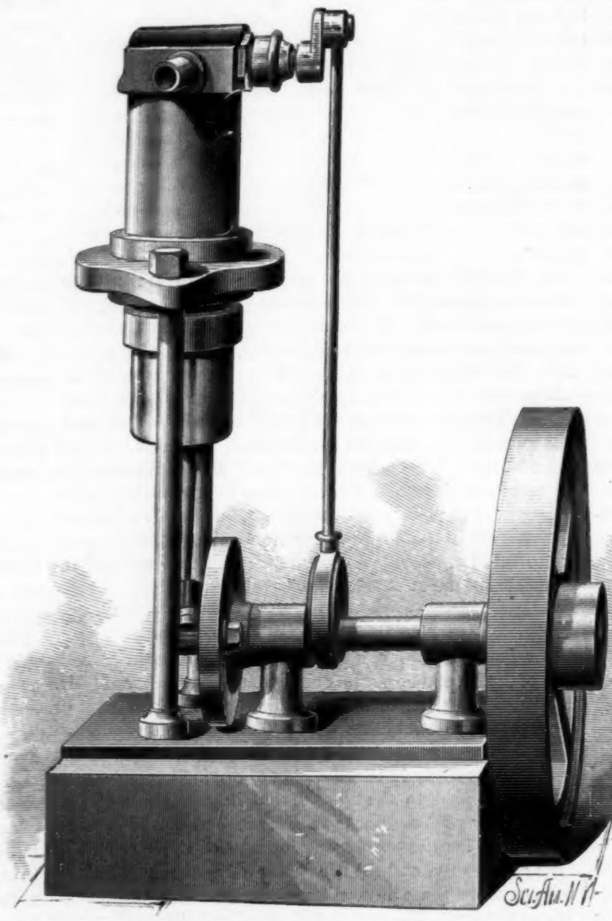
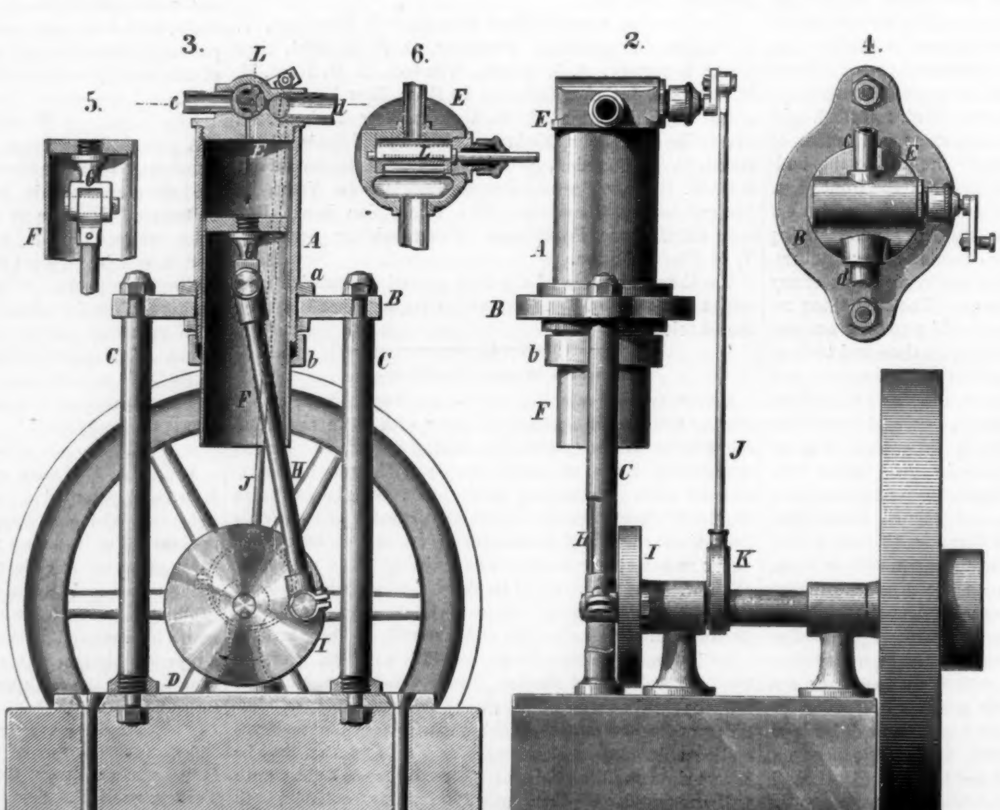


Fig. 1.—SIMPLE SINGLE-ACTING STEAM ENGINE.



SIDE ELEVATION, SECTIONAL, AND DETAIL VIEWS OF SIMPLE ENGINE.

MISCELLANEOUS INVENTIONS.

An improved finger ring has been patented by Mr. David Untermeyer, of New York city. The object of this invention is to furnish finger rings so constructed that they can be opened out to represent serpents, and which, when being worn, will give no indication of being anything more than rings.

An improved heel skate-fastener has been patented by Mr. Elijah S. Coon, of Watertown, N. Y. This invention consists, essentially, of a screw-threaded hollow plug or thimble, a dirt plate for covering the opening in the plug, and a spring for holding the dirt plate in place. This fastener possesses several advantages over one that is permanently attached to the heel. Being cylindrical, it is more easily connected, because the hole for its reception can be made with a common auger or bit without the necessity for lasting the boot or shoe or using a knife or chisel. Being screw threaded it can be readily screwed into place with a common screwdriver; this also enables it to be screwed either in or out, in order to make it fit the heel key. The screw thread permits of screwing it in beyond the surface of the heel, so as to prevent it from wearing out by the ordinary wearing of the shoe.

An improved velocipede has been patented by Messrs. Charles E. Tripler and William H. Roff, of New York city. The object of this invention is to obtain a more advantageous application of the propelling power than the ordinary cranks, to avoid the noise of pawls and ratchets, and to guard the velocipedes against being overturned should one of the rear wheels pass over an obstruction.

Mr. Philip H. Paxon, of Camden, N. J., has patented a machine that will cut lozenges in a perfect manner, and will not be clogged by the gum and sugar of the lozenge dough.

Mr. John H. Robertson, of New York city, has patented an improved mat, which consists of longitudinal metal bars provided with alternate mortised and tenoned ends, and composed of series of sockets united by webs and of wooden transverse rods entered through said sockets and held therein by vertical pins.

Mr. Charles F. Clapp, of Ripon, Wis., has patented a novel arrangement of a desk attachment for trunks. The desk and tray may be lifted from the trunk when the desk is either raised or lowered.

A combined scraper, chopper, and dirter has been patented by Messrs. Francis A. Hall and Nathaniel B. Milton, of Monroe, La. The object of this invention is to furnish an implement so constructed as to bar off a row of plants, chop the plants to a stand, and dirt the plants at one passage along the row, and which shall be simple, convenient, and reliable.

Mr. Hermann H. Cammann, of New York city, has patented a basket so constructed that it can be compactly folded for transportation or storage.

Messrs. David H. Seymour and Henry R. A. Boys, of Barrie, Ontario, Canada, have patented an improvement in that class of devices that are designed to be applied to steam cylinders for introducing oil or tallow into the cylinder and upon the cylinder valves. It consists of an oil cup provided with a gas escape, a scum breaker, an interior gauge, and an adjustable feed pipe extension.

Mr. John H. Conrad, of Charlotte, Mich., has patented a portable sliding gate which will dispense with hinges and which can be used in any width of opening. It may be readily connected with a temporary opening or gap made in the fence.

An improved reversible pole and shaft for vehicles has been patented by Mr. Francis M. Heuett, of Jug Tavern, Ga. The object of this invention is to so combine the parts of shafts for vehicles that they may be readily transposed and re-employed to form the tongue without removing the thill arms or hounds from the axle.

Mr. William Jones, of Kalamazoo, Mich., has patented an improved box which is useful for various purposes, but is particularly intended for shipping fourth class mail matter. The feature of special novelty is the means of fastening the hinged cover.

Mr. Louis J. Halbert, of Brooklyn, N. Y., has patented an improved slate cleaner, which is simple, convenient, and effective.

An improved boot, which is simple in its make, fits well, and is convenient to put on and take off, has been patented by Ellene A. Bailey, of St. Charles, Mo. The boot is provided with side seams, one of which is open at its lower end, and is provided with lacing, buttons, or a like device, so that it can be closed when the boot is on the wearer's foot.

THE HERCULES BEETLE.

In the handsome engraving herewith are shown the male and female of the Hercules beetle (*Dynastes hercules*) of Brazil. The family of the *Dynastidæ* comprises some of the largest and most beautiful of the beetle race, and all of them are remarkable for enormous developments of the thorax and head. They are all large bodied and stout limbed, and by their great strength abundantly justify their generic name, *Dynastes*, which is from the Greek and signifies *powerful*. The larvæ of these beetles inhabit and feed upon decaying trees and other rotting vegetable matter, and correspond in size with the mature insects. Most of them inhabit tropical regions, where they perform a valuable service in hastening the destruction of dead or fallen timber.

An admirable example of this family of beetles is the one here represented. In the male of the Hercules beetle the upper part of the thorax is prolonged into a single, downward curving horn fully three inches long, the entire length of the insect being about six inches. The head is prolonged into a similar horn, which curves upward, giving the head and thorax the appearance of two enormous jaws, resembling the claw of a lobster. The real jaws of the insect are underneath the lower horn, which projects from the forepart of the head. The under surface of the thorax-horn carries a ridge of stiff, short, golden-yellow hairs, and the under surface and edges of the abdomen are similarly ornamented.

The head, thorax, and legs are shining black; the elytra, or wing-covers, are olive-green, dotted with black spots, and are much wrinkled. The wings are large and powerful.

The female Hercules is quite unlike the male. It is much smaller, being not more than three and a half inches long, is without horns, and is covered with a brown hairy felt.

These beetles are nocturnal in habit, and are rarely seen in the daytime, except in dark hiding places in the recesses of Brazilian forests.

THE HERCULES BEETLE.

A Poulterer's View of Mechanical Poultry Raising.

A prominent dealer in poultry, Mr. H. W. Knapp, of Washington Market, gives a discouraging opinion of the probable success of chicken raising by artificial means in this country. He said recently when questioned on this subject by a representative of the *Evening Post*:

"I went to France to study the matter, for if it can be made to succeed it will make an immense fortune, as it has already done in Paris. I was delighted with what I saw there, and the matter at first sight seems to be so fascinating that I do not wonder that new men here are always ready to take hold of it as soon as those who have bought dear experience are only too glad to get out of it. Even clergymen and actors are bitten with the desire to transform so many pounds of corn into so many pounds of spring chicken. The now successful manager, Mackaye, spent about a thousand dollars in constructing hatching machines and artificial mothers in Connecticut, but he found that the stage paid better, and his expensive devices may now be bought for the value of old tin.

"Enthusiasts will tell you that by the new discovery chickens may be made out of corn with absolute certainty. In Paris this has been done; but the conditions are entirely different here. There the land is valuable, and they cannot devote large fields to a few hundred chickens; the French climate is so uniform that the markets of Paris cannot be supplied from the south with produce which ripens or matures before that of the neighborhood of Paris; the price of chickens is so high and labor so cheap that more care can be given with profit to one spring chicken than one of our poultry raisers could give to a dozen. Here we have plenty of land, the climate south of us is so far advanced in warmth that even with steam we cannot raise poultry ahead of the south, and the margin of profit is so small that one failure with a large batch of chickens sweeps away the profits from several successful experiments.

"When persons wanted me to go into the project I declined and was called an old fogy. One man spent a fortune on the enterprise in New Jersey, and at first was hailed as a public benefactor. What was the result of all his outlay and work? He managed to hatch quantities of young chickens every February, but although he could fatten them by placing them in boxes and forcing a fattening mixture down their throats, he could not make them grow; they had no exercise; they remained puny little things, and another defect soon appeared: though fat they were tough and stringy. The breeder sent lots of them to me, and they looked fat and tender; but my customers complained that they could not be young, for they were tough and tasteless, and that I must have sold them aged dwarfs under the name of spring chickens. It was found absolutely necessary to let them run out of doors as soon as the weather allowed it, and by the time that they were ready for market the southern chickens were here and could be sold for less than these. The upshot of the business is that this breeder has sold out, and another man has now taken hold of a small part of his old establishment to try other methods of making it a success.

"As to raising turkeys in that manner it will fail more disastrously than the chicken business. Size and weight are wanted in turkeys; and that reminds me," continued Mr. Knapp, "that the newspapers ought to impress the country people with the necessity of improving their poultry stock; breeding in and in is ruining poultry; every year the stock we receive is deteriorating, and this is the cause. I could give you some striking examples from my experience of forty years in the business. Some years ago we poulterers thought that ducks were going to disappear from bills of fare altogether; they were tasteless, worthless birds which people avoided. On Long Island a farmer made experiments in breeding with an old Muscovy drake, tough as an alligator, and the common duck. The result was superb and has changed the whole duck industry. If the farmers of Southern New Jersey, the sandy country best suited to turkeys, would bring from the West a few hundred wild turkeys we should have an immediate improvement. I see no such turkey now as we had twenty years ago. The breast is narrow and the body runs to length; it is all neck and legs, and can be bought by the yard. Rhode Island sends us the best turkeys, but they are not what they used to be. If, instead of attempting to beat nature at her own game, the rich men who have money to spend would devote it to better breeding, there would be an improvement. I do not yet despair of seeing immense farms wholly devoted to raising better poultry than we yet have."

The Embrace of the Mantis.

Mr. Addison Ellsworth favors us with a transcript of a letter from Mr. Albert D. Rust, of Ennis, Ellis County, Texas, describing a remarkable exhibition of copulative cannibalism on the part of the mantis. The ferocious nature of these strange insects is well known, and is in striking contrast with the popular name, "praying mantis," which they have gained by the pious attitude they take while watching for the flies and other insects which they feed upon.

About sunrise, August 28, 1880, Mr. Rust's attention was attracted by a pair of mantis, whether *Mantis religiosa* or not, he was not sure, but from the length of the body and the shortness of the wings he was inclined to think them of some other species. The female had her arms tightly clasped around the head of the male, while his left arm was around her neck. Mr. Rust watched intently to see whether the embrace was one of war or for copulation. It proved to be both. As the two abdomens began to approach each other the female made a ferocious attack upon the male, greedily devouring his head, a part of the body, and all the arm that had encircled her neck. A moment after the eating began, Mr. Rust observed a complete union of the sexual organs, and the eating and copulation went on together. On being forcibly separated the female exhibited signs of fear at her headless mate, and it was with difficulty that they were brought together again. On being suddenly tossed upon the back of the female the male seized her with a grasp from which she could not extricate herself, and immediately the sexual union was renewed, to all appearances as perfectly as before.

The pair were accidentally killed, otherwise, Mr. Rush thinks, the female would have continued her cannibalistic repast until she had devoured the entire body of her companion.

This peculiarity of the mantis seems not to have been observed before, though their mutually destructive disposition has been noted by several. Desiring to study the development of these insects, M. Roesel raised a brood of them from a bag of eggs. Though plentifully supplied with flies, the young mantis fought each other constantly, the stronger devouring the weaker, until but one was left.

M. Poiret was not more successful. When a pair of mantis were put together in a glass they fought viciously, the fight ending with the decapitation of the male and his being eaten by the female.

VARIEGATION OF LEAVES.

BY JAMES HOGG.

At the meeting of the Association of Nurserymen in Chicago, last July, one of our prominent horticulturists described leaf variegation as a disease. Incidentally this brought up the question: Does the graft affect the stock upon which it is inserted?

Much confusion of ideas exists upon this subject, largely due to a loose application of the term disease. Strictly speaking, this term is only applicable to that which shows the health of the plant to be impaired. It should be distinguished from aberrant or abnormal forms, for these are not necessarily indicative of disease. Nobody thinks of saying that red or striped roses are diseased because they are departures in color from the white flower of the type species; or that white, yellow, or striped roses are diseased when the color of the type species is red. Nobody thinks of saying that double flowers are evidences of disease in the plant, or that diminution in the size of leaves or variation in their form is a disease. Why then should it be said that because leaves may become of some other color than green, or become party-colored, therefore they are diseased? If it be said that flowers are not leaves, and that therefore the analogy is not a good one, the reply is, that flowers in all their parts, and fruits also, are only leaves differently developed from the type. This fact is a proven one, and so admitted to be by all botanists and vegetable physiologists of the present day. If it be objected that by becoming double, flowers lose the power of reproducing the variety or species, the answer is, that this loss of power is not necessarily the result of disease, but may arise from various other causes. Because an animal is castrated, it surely will not be claimed that therefore it is diseased. In man and in the higher animals the power of reproduction ceases at certain ages, but it cannot therefore be said that such men or animals are diseased. Neither is a redundancy of parts an unequivocal evidence of disease.

Topknot fowls and ducks are as healthy as those which do not have such appendages, and a Shetland pony is as healthy as a Percheron horse, notwithstanding the difference in their size and weight. Again, color in block or in variegation is not positive evidence of disease in animal life. The white Caucasian is as healthy as the negro, the copper-colored Malay as the red Indian. The horse, ox, and hog run through white and red to black both in solid and party-color, and all are equally healthy; so with the rabbit, dog, cat, and others of our domestic animals. In wild animals, birds, reptiles, fishes, and insects, it is the same, so that mere difference in color or combinations of color are not *prima facie* evidence of disease.

But some will say this may be true of animal life, but not of plant life. That there is a strong and evident analogy, the one with the other, is now universally admitted by physiologists. Formerly many physiologists considered leaf variegation a disease, because it generally ran in stripes lengthwise of the leaf or in spots. In the former case it was supposed to originate from disease in the leaf cells of the leaf stalk, which, as the cells grow longitudinally, naturally prolonged it to the end of the leaf. But the originating of varieties in which the variegation did not assume this form, with other considerations, has done much to upset this theory. In the variegated leaved snowberry we have the center and border of the leaf green, separated the one from the other by an isolated white or yellow zone. In the zebra-leaved eulalia and the zebra-leaved juncus, from Japan, we have the variegation of the leaf transversely instead of longitudinally, so that according to the old theory we have the anomaly of a healthy portion of the leaf producing an unhealthy portion, and that again a healthy one, and thus alternately along the whole length of the leaf.

When we dissect a leaf in its primal development, we find that its cells contain colorless globules, by botanists called chlorophyl or phyto-color; these undergo changes according as they are acted upon by light, oxygen, or other agents, producing green, yellow, red, and other tints. This chlorophyl only exists in the outer or superficial cells of the parenchyma or cellular tissue of the leaf, and thus differs from starch and other substances produced in the internal cells, from which the light is more or less excluded. It is a fatty or wax-like substance, readily dissolved in alcohol or ether. The primal color of all leaves and flowers is white or a pale yellowish hue, as can readily be seen by cutting open a leaf or flower bud. The seed leaves of the French bean are white when they come out of the earth, but they become green an hour afterward under the influence of bright sunshine. A case is on record where in a certain section, some miles in extent, in this country, about the time of the trees coming into leaf, the sun did not shine for twenty days; the leaves developed to nearly their full size, but were of a pale or whitish color; finally, one forenoon the sun shone out fully, and by the middle of the afternoon the trees were in full summer dress. These facts show that the green color of leaves is due to the action of light. Variegation is sometimes produced independently of the chlorophyl, as in *Begonia argyrostigma* and *Carduus marianus*, in which it is produced by a layer of air interposed between the epidermis or outer skin of the leaf and the cells beneath; this gives the leaf a bright, silvery appearance.

To what, then, are we to ascribe leaf variegation? I think that it is entirely due to diminished root power; by this I do not mean that the roots are diseased, but that they are either in an aberrant or abnormal state; but disease cannot be predicated upon either of these states. To explain: everybody knows *Spiræa callosa* to be a strong growing shrub, having umbels of rosy-colored flowers and strong, stout roots; the white flowered variety is quite dwarf, is more leafy and bushy than the species, and has more fibrous and delicate roots than the type; the crisp-leaved variety is still more dwarf, very bushy, and very leafy, and has very fine thread-like roots. This would indicate that the aberrance is in the roots; the two varieties are much more leafy in proportion to their size than the species, so that if the leaves controlled the roots, the latter should have been larger in proportion than those of the species. Again, once when, in the autumn, I was preparing my greenhouse plants for their winter quarters, I cut back a "Lady Plymouth" geranium, which chanced to be set away in a cool and somewhat damp cellar. When discovered the following February and started into growth in the greenhouse it produced nothing but solid green leaves, and never afterward produced a variegated leaf. This I attributed to its having gained greater root power during its long season of rest. By this I mean that the roots had grown and greatly increased in size, although there had not been any leaf growth. That roots under certain circumstances do so is well known. The roots of fir trees have been found alive and growing forty-five years after the trunks were felled. The same has occurred in an ash tree after its trunk had been sawn off level with the ground. A root of *Ipomœa sellowii* has been known to keep on growing for twelve years after its top had been destroyed by frost; and in all that time it never made buds or leaves, yet it increased to seven times its original weight. The tuberous roots of some of the *Tropæolums* will continue to grow and increase in size after the tops have been accidentally broken off; and potatoes buried so deep in the earth that they cannot produce tops will produce a crop of new potatoes.

On the other hand, I have had an oak-leaved geranium overlooked in a corner of the greenhouse until it was almost dried up for lack of water. When its branches were pruned back and it was started into growth only one branch showed the almost black center of the leaf, all the rest were clear green. This was an evident case of diminished root power, but the plant grew as thriftily as ever. The lack of the dark marking in the leaves was equivalent to the variegation in other varieties, only in a reverse direction.

In practice, when gardeners wish to produce an abnormal condition in a tree or plant, they will, if they wish to dwarf it, graft it on a species or variety of diminished root power, and contrariwise, if they wish to increase its growth, will graft it upon a stock of strong root power. But in neither case can the graft be said to be diseased by the action of the roots of the stock.

When this root power is so far diminished as to produce complete albinism, the shoots from such roots appear to partake of this diminished power, and to lose the power of making roots, and thus become very difficult to propagate. It is sometimes said that albino cuttings cannot be rooted at all, but this is a mistake, for I have succeeded in striking such cuttings from the variegated leaved *Hydrangea*. It required much care to do it; they did not, however, retain their albino character after they rooted and started into growth.

Albinism and white variegation in leaves appear to be due to the chlorophyl in such leaves being able to resist the action of the three (red, yellow, and blue) rays of light. What we call color in any subtance or thing is due to its reflecting these different rays in various proportions of combination and absorbing the rest of them, the various proportions giving the various shades of color. White is due to the reflection of all of them, and black to the absorption of them. In some plants with variegated foliage we have the curious fact that the cells containing chlorophyl reflecting one color produce cells which reflect an entirely different color. In the coleus "Lady Burrill," for instance, the lower half of the leaf is of a deep violet-crimson color, and the upper half is golden yellow. In other varieties of coleus, in *Perilla nankiensis*, and other plants, we have foliage without a particle of green in it, and yet they are perfectly healthy. This shows that green leaves are not absolutely necessary to the health of a plant.

As a proof of leaf variegation being a disease, the speaker alluded to cited a case in which a green leaved abutilon, upon which a variegated leaved variety had been grafted, threw out a variegated leaved shoot below the graft. This can easily be explained. The growth of the trunk or stem of all exogenous plants, or those which increase in size on the outside of the stem, is brought about by the descent of certain formative tissue called cambium, elaborated by the leaves and descending between the old wood and the bark, where it is formed into alburnum or woody matter. Some think that it is also formed by the roots and ascends from them as well as descending from the leaves. Be this as it may, there is no doubt about its descent. In such comparatively soft-wooded, free growing plants as the abutilon the descent of the cambium is very free and in considerable quantity, so that the stock would soon be inclosed in a layer of it descending from the graft. When being converted into woody matter it also forms adventitious buds which under certain favorable circumstances will emit shoots of the same character as the graft from which it was derived. The graft in such cases may be said to inclose the stock in a tube of its own substance, leaving the stock unaffected otherwise. The variegated shoot in this case was in reality derived from the downward growth of the graft and not from the original stock, which was not therefore contaminated by the graft. In cases where the stock is of much slower growth than the graft, or the graft is inserted upon a stock of some other species, the descending cambium does not inclose the stock, but makes layers of wood on the stem of the graft, which thus, as is frequently seen, overgrows the stock, sometimes to such an extent as to make it unsightly. Nobody ever saw an apple shoot from a crab stock, a pear from a quince stock, or a peach shoot from a plum stock. This is one of the arguments in favor of the view that cambium also rises from the roots.

Again, to show that the stock is not affected by the graft, or the graft by the stock, except as to root power, let any person graft a white beet upon a red beet, or contrariwise, when about the size of a goosequill, and when they have attained their full growth, by dividing the beet lengthwise he will find the line of demarkation between the colors perfectly distinct, neither of them running into the other.

The theory that leaf variegation is a disease has been held by many distinguished botanists and is in nowise new. But this theory has been controverted, and we think successfully, by other botanists, and it is not now accepted by the more advanced vegetable physiologists. There are now so many acute and industrious students and observers in every department of science, and the accumulation of facts is so rapid and so great, that very many of the older theories are being set aside as not in accord with the newly discovered facts. A student brought up in institutions where the old theories are inculcated has afterward to spend half his time in unlearning what he had been previously taught, and the other half in studying the new facts brought to his notice and testing the theories promulgated by men of science. Botanical science does not wholly consist in the classification and nomenclature of plants, but largely consists in a knowledge of vegetable anatomy and physiology, and these require much study and some knowledge of other sciences, such as chemistry, meteorology, geology, etc. Without such general knowledge it is difficult to form a harmonious theory in regard to any of the phenomena of plant life.

Vanilla, Cinnamon, Cocoanut.

The following interesting facts concerning the cultivation of the above products in the island of Ceylon, were given in Mr. H. B. Brady's recent address before the British Pharmaceutical Conference at Swansea:

The vanilla plant is trained on poles placed about twelve or eighteen inches apart—one planter has a line of plants about three miles in length. Like the cardamom, it yields fruit after three years, and then continues producing its pods for an indefinite period.

The cinnamon (*Cinnamomum zeylanicum*) is, as its name indicates, a native of Ceylon. It is cultivated on a light sandy soil about three miles from the sea, on the southwest coast of the island, from Negumbo to Matura. In its cultivated state it becomes really productive after the sixth year, and continues from forty to sixty years. The superintendent of the largest estate in this neighborhood stated that there were not less than fifteen varieties of cinnamon, sufficiently distinct in flavor to be easily recognized. The production of the best so injures the plants that it does not pay to cut this at any price under 4*s*. 6*d*. to 5*s*. per lb. The estate alluded to above yields from 30,000 to 40,000 lb. per annum; a uniform rate of 4½*d*. per lb. of finished bark is paid for the labor. Cinnamon oil is produced from this bark by distillation; the mode is very primitive and wasteful. About 40 lb. of bark, previously macerated in water, form one charge for the still, which is heated over a fire made of the spent bark of a previous distillation. Each charge of bark yields about three ounces of oil, and two charges are worked daily in each still.

The cultivation of the cocoanut tree and the production of the valuable cocoanut oil are two important Cingalese occupations. These trees, it appears, do not grow with any luxuriance at a distance from human dwellings, a fact which may perhaps be accounted for by the benefit they derive from the smoke inseparable from the fires in human habitations. The cultivation of cocoanuts would seem to be decidedly profitable, as some 4,000 nuts per year are yielded by each acre, the selling price being £3 per thousand, while the cost of cultivation is about £2 per acre. In extracting the oil, the white pulp is removed and dried, roughly powdered, and pressed in similar machinery to the linseed oil crushing mills of this country. The dried pulp yields about 60 per cent by weight of limpid, colorless oil, which in our climate forms the white mass so well known in pharmacy.

Learning to Tie Knots.

A correspondent suggests that it would be a handy accomplishment for schoolboys to be proficient in the handling, splicing, hitching, and knotting of ropes. He suggests the propriety of having the art taught in our public schools. A common jackknife and a few pieces of clothes line are the main appliances needed to impart the instruction with. He concludes it would not only be of use in ordinary daily life, but especially to those who handle merchandise and machinery. Any one, he adds, who has noticed the clumsy haphazard manner in which boxes and goods are tied for hoisting or for loading upon trucks, will appreciate the advantage of practical instruction in this direction. Probably a good plan, he further suggests, would be to have one schoolboy taught first by the master, and then let the pupil teach the other boys. Our correspondent thinks most boys would consider it a nice pastime to practice during recess and at the dinner hour, so that no time would be taken from study or recitation time.

DECISIONS RELATING TO PATENTS.

Supreme Court of the United States

PEARCE *vs.* MULFORD *et al.*

Appeal from the Circuit Court of the United States for the Southern District of New York.

1. Reissued patent No. 5,774 to Shubael Cottle, February 24, 1874, for improvement in chains for necklaces, declared void, the first claim, if not for want of novelty, for want of patentability, and the second for want of novelty.

2. Neither the tubing, nor the open spiral link formed of tubing, nor the process of making either the open or the closed link, nor the junction of closed and open spiral links in a chain, was invented by the patentee.

3. All improvement is not invention and entitled to protection as such. Thus to entitle it it must be the product of some exercise of the inventive faculties, and it must involve something more than what is obvious to persons skilled in the art to which it relates.

The decree of the circuit court is therefore reversed, and it is ordered that the bill be dismissed.

By the Commissioner of Patents.

DICKSON *vs.* KINSMAN.—INTERFERENCE.—TELEPHONE.

The subject matter of the interference is defined in the preliminary declaration thereof as follows:

The combination in one instrument of a transmitting telephone and a receiving telephone, so arranged that when the mouthpiece of the speaking or transmitting telephone is applied to the mouth of a person, the orifice of the receiving telephone will be applied to his ear.

1. While it is true that the unsupported allegations of an inventor, that he conceived an invention at a certain date, are not sufficient to establish such fact, the testimony of a party that he constructed and used a device at a certain time is admissible.

2. Abandonment is an ill-favored finding, which cannot be presumed, but must be conclusively proven.

The decision of the Board of Examiners-in-Chief is reversed, and priority awarded to Dickson.

Characteristics of Arctic Winter.

Lieutenant Schwatka, whose recent return from a successful expedition in search of the remains of Sir John Fanklin's ill-fated company, combats the prevalent opinion that the Arctic winter, especially in the higher latitudes, is a period of dreary darkness.

In latitude 83° 20′ 20″ N., the highest point ever reached by man, there are four hours and forty-two minutes of twilight on December 22, the shortest day in the year, in the northern hemisphere. In latitude 82° 27′ N., the highest point where white men have wintered, there are six hours and two minutes in the shortest day; and latitude 84° 32′ N., 172 geographical miles nearer the North Pole than Markham reached, and 328 geographical miles from that point, must yet be attained before the true Plutonic zone, or that one in which there is no twilight whatsoever, even upon the shortest day of the year, can be said to have been entered by man. Of course, about the beginning and ending of this twilight, it is very feeble and easily extinguished by even the slightest mists, but nevertheless it exists, and is quite appreciable on clear cold days, or nights, properly speaking. The North Pole itself is only shrouded in perfect blackness from November 13 to January 29, a period of seventy-seven days. Supposing that the sun has set (supposing a circumpolar sea or body of water unlimited to vision) on September 24, not to rise until March 18, for that particular point, giving a period of about fifty days of uniformly varying twilight, the pole has about 188 days of continuous daylight, 100 days of varying twilight, and 77 of perfect inky darkness (save when the moon has a northern declination) in the period of a typical year. During the period of a little over four days, the sun shines continuously on both the North and South Poles at the same time, owing to refraction parallax, semi-diameter, and dip of the horizon.

The Collins Line of Steamers.

The breaking up of the Baltic, the last of the famous Collins line of steamships, calls out a number of interesting facts with regard to the history of the several vessels of that fleet. There were five in all, the Adriatic, Atlantic, Pacific, Arctic, and Baltic. They were built and equipped in New York. Their dimensions were: Length, 290 feet; beam, 45 feet; depth of hold, 31½ feet; capacity, 2,860 tons; machinery, 1,000 horse power. In size, speed, and appointments they surpassed any steamers then afloat, and they obtained a fair share of the passenger traffic. A fortune was expended in decorating the saloons. The entire cost of each steamer was not less than $600,000, and notwithstanding their quick passages, the subsidy received, and the high rates of freight paid, the steamers ran for six years at great loss, and finally the company became bankrupt.

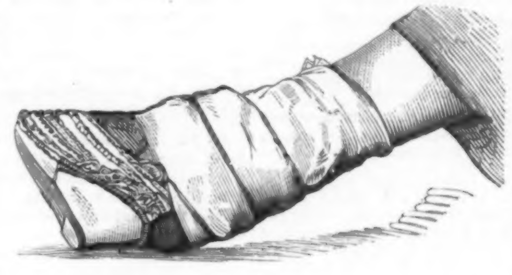
The Atlantic was the pioneer steamship of the line. She sailed from New York April 27, 1849, and arrived in the Mersey May 10, thus making the passage in about thirteen days, two of which were lost in repairing the machinery; the speed was reduced in order to prevent the floats from being torn from the paddle-wheels. The average time of the forty-two westward trips in the early days of the line was 11 days 10 hours and 26 minutes, against the average of the then so-called fastest line of steamers, 12 days 19 hours and 26 minutes. In February, 1852, the Arctic made the passage from New York to Liverpool in 9 days and 17 hours. The Arctic was afterward run into by a French vessel at sea and only a few of her passengers were saved. The Pacific was never heard from after sailing from Liverpool, and all the persons on board were lost. The Atlantic, after rotting and rusting at her wharf, was deprived of her machinery and converted into a sailing vessel, and was broken up in New York last year. The Adriatic, the "queen of the fleet," made less than a half dozen voyages, was sold to the Galway Company, and is now used in the Western Islands as a coal hulk by an English company.

The Baltic was in the government service during the war as a supply vessel, and was afterward sold at auction; her machinery was removed and sold as old iron. She was then converted into a sailing ship, and of late years has been used as a grain carrying vessel between San Francisco and Great Britain. On a recent voyage to Boston she was strained to such an extent as to be made unseaworthy, and for that reason is to be broken up.

One cannot but remark in this connection how small has been the advance in steamship building during the quarter century since the Collins line was in its glory.

CHINESE WOMEN'S FEET.

An American missionary, Miss Norwood, of Swatow, recently described in a *Times* paragraph how the size of the foot is reduced in Chinese women. The binding of the feet is not begun till the child has learnt to walk. The bandages are specially manufactured, and are about two inches wide and two yards long for the first year, five yards long for subsequent years. The end of the strip is laid on the inside of



CHINESE WOMEN'S FEET.

the foot at the instep, then carried over the toes, under the foot, and round the heel, the toes being thus drawn toward and over the sole, while a bulge is produced on the instep, and a deep indentation in the sole. Successive layers of bandages are used till the strip is all used, and the end is then sewn tightly down. The foot is so squeezed upward that, in walking, only the ball of the great toe touches the ground. After a month the foot is put in hot water to soak some time; then the bandage is carefully unwound, much dead cuticle coming off with it. Frequently, too, one or two toes may even drop off, in which case the woman feels afterward repaid by having smaller and more delicate feet. Each time the bandage is taken off, the foot is kneaded to make the joints more flexible, and is then bound up again as quickly as possible with a fresh bandage, which is drawn up more tightly. During the first year the pain is so intense that the sufferer can do nothing, and for about two years the foot aches continually, and is the seat of a pain which is like the pricking of sharp needles. With continued rigorous binding the foot in two years becomes dead and ceases to ache, and the whole leg, from the knee downward, becomes shrunk, so as to be little more than skin and bone. When once formed, the "golden lily," as the Chinese lady calls her delicate little foot, can never recover its original shape.

Our illustrations show the foot both bandaged and unbandaged, and are from photographs kindly forwarded by Mr. J. W. Bennington, R. N., who writes: "It is an error to suppose, as many do, that it is only the Upper Ten among the daughters of China that indulge in the luxury of 'golden lilies,' as it is extremely common among every class, even to the very poorest—notably the poor sewing women one sees in every Chinese city and town, who can barely manage to hobble from house to house seeking work. The pain endured while under the operation is so severe and continuous that the poor girls never sleep for long periods without the aid of strong narcotics, and then only but fitfully; and it is from this constant suffering that the peculiar sullen or stolid look so often seen on the woman's face is derived. The origin of this custom is involved in mystery to the Westerns. Some say that the strong-minded among the ladies wanted to interfere in politics, and that there is a general liking for visiting, chattering, and gossip (and China women *can* chatter and gossip), both and all of which inclinations their lords desired, and desire, to stop by crippling them."

To the alteration and metamorphism of rocks by the infiltration of rain and other meteoric waters, M. De Koninck, of the Belgian Academy of Sciences, assigns the cause of many hitherto unexplained phenomena in geology.

Correspondence.

Ice at High Temperatures.

To the Editor of the Scientific American:

Your issues of October 23 and 30 contain some remarkable articles under the heading of "Ice at High Temperatures."

Prof. Carnelley says: "In order to convert a solid into a liquid, the *pressure* must be above a certain point, otherwise no amount of heat will melt the substance," as it passes at once from the sold state into the state of gas, subliming away without previous melting. And, "having come to this conclusion, it was easily foreseen that it would be possible to have solid ice at temperatures far above the ordinary melting point."

The first conclusion of the professor is correct, but not new. The second conclusion is new, but very doubtful as to its correctness, and certainly does not follow as a sequence from his premise.

If we try to heat ice in a vacuum, we cannot apply any heat to the ice direct, but only to the vessel containing the ice. The vessel may be much heated; but whether it will convey heat to the ice quick enough to heat it over 32°, and whether at all it can be heated over 32°, this is a question of a different nature. Before crediting such a conclusion we must know more of the details of the experiments which the professor made in order to verify its correctness. When saying that "on one occasion a small quantity of water was frozen in a glass vessel which was so hot that it could not be touched by the hand without burning it," he evidently assumes that if the vessel is hot, the ice inside must be equally so; but this assumption is erroneous. Faraday has made water to freeze in a red hot platina pot; the ice thus formed was not red hot like the platina, but was below the freezing point. Just so with Professor Carnelley's glass vessel: the vessel was hot, but the ice inside no doubt was "ice cold." If the professor would surround a thermometer bulb with ice and then make the mercury rise above the freezing point, we would believe in "hot ice;" not before. Until he does, we prefer to believe that the heat conveyed through the vessel to the ice is all absorbed in vaporizing the ice, and not in raising its temperature above 32°.

Professor Carnelley's further statement, apparently proving his theory, that the ice at once liquefies as soon as *pressure* is admitted (say by admitting air), is readily accounted for by the phenomena connected with the "Leydenfrost Drop." Water in a red hot vessel will vaporize off much slower than in a vessel heated a little above the boiling point, from the reason that in the red hot vessel no *real contact* takes place between the vessel and the water. At the place where the two ought to touch, steam is formed quicker than it can escape, which steam prevents the contact between vessel and water; therefore, as no real contact takes place, the heat from the vessel can pass into the water but slowly, viz., in the proportion as it works itself through the layer of steam, which in itself is a bad conductor. Just so in Prof. Carnelley's experiment: The heated glass vessel will convey heat to the ice only at those points where it touches the ice; at those points at once a formation of vapor takes place, which prevents an intimate contact between the glass and the ice, so that they do not really touch each other, consequently the heat can pass into the ice but slowly, having to work its way through the thin layer of rarefied vapor between the two. As soon as pressure is admitted by admitting atmospheric air, vapors can no longer form; an intimate contact will take place between the glass and the ice, and consequently the heat be conveyed over quick enough to make the ice melt away rapidly.

The professor's experiments, therefore, so far as published, do not prove anything to justify his strange conclusion. It is perfectly true that in a vacuum of less than 4·6 mm. mercury pressure, no amount of heat will melt ice, all heat that can be conveyed to the ice being absorbed by vaporization. But before crediting the professor's further conclusion, that ice can be heated much above the freezing point, he must actually produce "hot ice," not only a hot vessel containing ice. N. J.

Brooklyn, N. Y., October 25, 1880.

Schools of Invention.

The school of invention has not yet been established, but its germ is growing in the mechanical schools. This school, according to Hon. W. H. Ruffner, in *Va. Ed. Journal*, will educate men, and women too, for the special career of inventing new things. Why not? We already have something closely analogous in schools of design, where the pupil is trained to invent new forms or patterns, chiefly of an artistic or decorative character. The same idea will be applied to the invention of machinery, or improvements in machinery, or the adaptation of machinery to the accomplishment of special ends. Inventions usually spring from individuals striving to lighten their own labor, or from some idea entering the brain of a genius. But we shall have professional inventors who will be called on to contrive original devices, and his success will depend on the sound and practical character of his prescriptions.

Proposed Exhibition of Bathing Appliances.

The Board of Health of this city has recently been notified that a Balneological Exhibition, to illustrate the various systems of bathing, bath appliances, and kindred matters, is to be held in Frankfort-on-Main, Germany, next summer. The exhibition will last from May to September, 1881.

H. H. Heinrich, No. 41 Maiden Lane, New York, Inventor. Patentee, and Sole Manufacturer of the Self-Adjusting Chronometer Balance, which is not affected by "extremes" of high and low temperatures, as fully demonstrated by a six months' test at the Naval Observatory at Washington, D. C., showing results in temperatures from 134° down to 18°, of 5-10 of a second only, unparalleled in the history of horology and certified to by Theo. F Kone, Esq., Commander U. S. N. in charge of the Observatory. Mr. Heinrich is a practical working mechanic and adjuster of marine and pocket chronometers to positions and temperatures, and is now prepared to apply his new balance wheel to any fine timekeeping instrument, either for public or private use: he also repairs marine and pocket chronometers, as well as all kinds of complicated watches, broken or lost parts made new and adjusted. Mr. Heinrich was connected for many years with the principal manufacturers of England, Geneva and Locle, Switzerland, and for the last fifteen years in the United States, and very recently with Messrs. Tiffany & Co., of Union Square, New York. Shipowners, captains, naval and army officers, railroad and telegraph officials, physicians and horsemen, and all others wanting true time, should send to him. Fine watches of the principal manufacturers, for whom he is their agent, constantly on hand. His office is connected by electric wires with the Naval Observatory's astronomical clock, through the Western Union Telegraph, thus giving him daily New York's mean time. Many years ago the British Government made an offer of £6,000 for a chronometer for her navy, keeping better time than the ones in use, but no European horologist ever discovered the sequel, which Mr. Heinrich has now worked out to perfection, overcoming the extremes, as stated above. With him is connected Mr. John F. Krugler, for thirty years connected with the trade as salesman.—*Adv.*

Troope's Felt and Asbestos Covering for Steam Pipes and other surfaces, illustrated on page 357, present volume, received a Medal of Excellence at the late American Institute Fair. See advertisement on another page.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion ; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Chard's Extra Heavy Machinery Oil.

Chard's Anti-Corrosive Cylinder Oil.

Chard's Patent Lubricene and Gear Grease.

R. J. Chard. Sole Proprietor, 6 Burling Slip, New York.

Wanted—Superintendent for six thousand spindle cotton yarn mill. State salary and references. Rosalie Yarn Mills, Natchez, Miss.

Use Vacuum Oil Co.'s Lubricating Oil, Rochester, N.Y.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Interesting to Manufacturers and Others.—The worldwide reputation of Asbestos Liquid Paints, Roofing, Roof Paints, Steam Pipe, Boiler Coverings, etc., has induced unscrupulous persons to sell and apply worthless articles, representing them as being made of Asbestos. The use of Asbestos in these and other materials for structural and mechanical purposes is patented, and the genuine are manufactured only by the H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

Three requisites—pens, pins, and needles. The two latter you can get of any make, but when you want a good pen get one of Esterbrook's.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 380.

Frank's Wood Working Mach'y. See illus. adv., p. 382.

Painters' list of 65 good recipes. J. J. Callow, Clevel'd, O.

Improved Speed Indicator. Accurate, reliable, and of a convenient size. Sent by mail on receipt of $1.50. E. H. Gilman, 21 Doane St., Boston, Mass.

Astronomical Telescopes, first quality & low prices, Eye Pieces, Micrometers, etc. W. T. Gregg, 75 Fulton St., N.Y.

Engines. Geo. F. Shedd, Waltham, Mass.

The Mackinnon Pen or Fluid Pencil. The commercial pen of the age. The only successful reservoir pen in the market. The only pen in the world with a diamond circle around the point. The only reservoir pen supplied with a gravitating valve; others substitute a spring, which soon gets out of order. The only pen accompanied by a written guarantee from the manufacturers. The only pen that will stand the test of time. A history of the Mackinnon Pen, its uses, prices, etc., free. Mackinnon Pen Co. 200 Broadway, New York.

Among the numerous Mowing Machines now in use, none ranks so high as the Eureka. It does perfect work and gives universal satisfaction. Farmers in want of a mowing machine will consult their best interests by sending for illustrated circular, to Eureka Mower Company, Towanda, Pa.

Peck's Patent Drop Press. See adv., page 333.

The Inventors Institute, Cooper Union Building, New York. Sales of patent rights negotiated and inventions exhibited for subscribers. Send for circular.

Fragrant Vanity Fair Tobacco and Cigarettes. 7 First Prize Medals—Vienna, 1873; Philadelphia, 1876; Paris, 1878; Sydney, 1879—awarded Wm. S. Kimball & Co., Rochester, N. Y.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The E. Stebbins Manuf'g Co. (Brightwood, P. O.), Springfield, Mass., are prepared to furnish all kinds of Brass and Composition Castings at short notice; also Babbitt Metal. The quality of the work is what has given this foundry its high reputation. All work guaranteed.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1½ Park Place, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 349.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N.Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 349.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

For Separators, Farm & Vertical Engines, see adv. p. 349.

For Patent Shapers and Planers, see ills. adv. p. 349.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 348.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can be sent C. O. D. for $8. A. H. Downer, 17 Peck Slip, New York.

Presses, Dies and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 349.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 366.

Silent Injector, Blower, and Exhauster. See adv. p. 380.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Clark Rubber Wheels adv. See page 381.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eclipse Portable Engine. See illustrated adv., p. 382.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 380.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 349.

Magic Lanterns, Stereopticons, and Views of all kinds and prices for public exhibitions. A profitable business for a person with small capital. Also lanterns for home amusement, etc. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

Lenses for Constructing Telescopes, as in Sci. Am. Supplement, No. 252, $6.50 per set; postage, 9 cts. The same, with eye piece handsomely mounted in brass, 8.00. McAllister, M'f'g Optician, 49 Nassau St., N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Penfield (Pulley) Blocks, Lockport N Y. See ad. p. 381.

4 to 40 H. P. Steam Engines. See adv. p. 381.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 380.

For Yale Mills and Engines, see page 381.

Lightning Screw Plates and Labor-saving Tools, p. 333.

English Patents Issued to Americans.

From November 9 to November 12, 1880, inclusive.

Book binding, L. Finger, Boston, Mass.
Draining and sewerage, G. E. Waring, Newport, R. I.
Electric gas lighter, G. D. Bancroft, Boston, Mass.
Electric signal, E. H. Johnson *et al.*, Menlo Park, N. J.
Horse nail manufacture, S. S. Putnam, Boston, Mass.
Hygienic confection, T. S. Lambert *et al.*, New York city.
Looms, F. O. Tucker, Hartford, Conn.
Reflectors for lamps, J. S. Goldsmith, New York city.
Railroad vehicles, E. R. Esmond *et al.*, New York city.
Sewing machine, G. F. Newell, Greenfield, Mass.
Steam boilers, D. Sutton, Cincinnati, Ohio.
Steam boilers, W. D. Dickey, New York city.
Toy money box, J. E. Walter, New York city.
Trucks, hand, E. J. Lyburn, Fredericksburg, U. S. A.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the Scientific American Supplement referred to in these columns may be had at this office. Price 10 cents each.

(1) L. L. asks: 1. How can I grind and polish quartz and agate rock, and what kind of grinding and polishing material should I use? A. Quartz and agate are slit with a thin iron disk supplied with diamond dust moistened with brick oil. The rough grinding is done on a lead wheel supplied with coarse emery and water. The smoothing is done with a lead lap and fine emery, and the polishing may be accomplished by means of a lead lap, whose surface is hacked and supplied with rottenstone and water. 2. What is the best method of polishing steel? A. The usual method is to grind first on a coarse wet stone, then on a fine wet stone, then on a lead lap supplied with fine emery and oil, and finally polish on a buff wheel supplied with dry crocus and revolving rather slowly.

(2) R. L. J. asks how to make copying black and red inks. A. 1. Bruised Aleppo nutgalls, 2 lb.; water, 1 gallon; boil in a copper vessel for an hour, adding water to make up for that lost by evaporation; strain and again boil the galls with a gallon of water and strain; mix the liquors, and add immediately 10 oz. of copperas in coarse powder and 8 oz. of gum arabic; agitate until solution of these latter is effected, add a few drops of solution of potassium permanganate, strain through a piece of hair cloth, and after permitting to settle, bottle. The addition of a little extract of logwood will render the ink blacker when first written with. Half an ounce of sugar to the gallon will render it a good copying ink. 2. Shellac, 4 oz.; borax, 2 oz.; water, 1 quart; boil till dissolved, and add 2 oz. of gum arabic dissolved in a little hot water; boil and add enough of a well triturated mixture of equal parts indigo and lampblack to produce the proper color; after standing several hours draw off and bottle. 3. Half a drachm of powdered drop lake and 18 grains of powdered gum arabic dissolved in 3 oz. of ammonia water constitute one of the finest red or carmine inks.

(3) X. inquires: What is the rule for making a counterbalanced face wheel for engines? A. It is a common practice to place the counter weight directly opposite the crank, with its center of gravity at the same distance from the center of the shaft as the center of the crank pin, making its weight equal to weight of piston, piston rod, crosshead, and crank pin, plus half the weight of the connecting rod.

(4) A. R. asks: What is the best way to remove cinders from the eye? A. A small camel's hair brush dipped in water and passed over the ball of the eye on raising the lid. The operation requires no skill, takes but a moment, and instantly removes any cinder or particle of dust or dirt without inflaming the eye.

(5) D. F. H. asks: Can I move a piston in a half inch glass tube by the expansion of mercury? A. Yes, but you will require a long tube to get any appreciable motion of the piston.

(6) J. W. asks: What size of a bore and what length of a stroke I would want for a rocking valve engine of half a horse power? A. About 2 inches cylinder and 3 inch stroke, depending upon pressure and velocity.

(7) R. W. H. writes: In a recent discussion on hot air and steam portable engines it was decided to ask your opinion, which should be final. Water is scarce, though enough to use steam is easily procured. The country is hilly, so that lightness is desirable. The power wanted is 6 horse, and movable, that is, on wheels. Which will be best, hot air engine or steam engine? Which consumes most coal for a given power? Which will be cheapest in above case? A. For small powers the hot air engine is most economical, but we do not think it adapted to your purpose. We would recommend the steam engine for a portable power.

(8) J. C. T. writes: 1. I have a water tank for supplying my boiler, which is made of No. 22 galvanized iron; size 30 inches by 9 feet 4 inches. How many gallons will it hold? A. 342 gallons. 2. Will it be better to have it painted inside? A. Yes. 3. How many years will the tank wear under favorable circumstances, using well water? A. Depends upon the care taken of it.

(9) W. H. C. asks: Is there any way of deadening the noise of machinery overhead from the engine room below? The noise comes from machinery in the weave room of an alpaca mill. A. This is generally accomplished by setting the legs of the machines on thick pieces of India-rubber or other non-conductor of sound.

(10) G. H. asks: How can I mount photos on glass and color them? A. Take a strongly printed photograph on paper, and saturate it from the back with a rag dipped in castor oil. Carefully rub off all excess from the surface after obtaining thorough transparency. Take a piece of glass an inch larger all round than the print, pour upon it dilute gelatin, and then "squeegee" the print and glass together. Allow it to dry, and then work in artists' oil colors from the back until you get the proper effect from the front. Both landscapes and portraits can be effectively colored by the above method without any great skill being required.

(11) C. W. S. asks: 1. Is there any practical and effective method known for cutting screws by connecting the slide rest with the mandrel of the lathe by gears or otherwise? A. This can be done in this way: attach a spur wheel to the back of the face plate. Mount a similar wheel on a short hollow shaft, and support the shaft by an arm bolted to the lathe bed so that the two spur wheels will mesh together. Fit right and left hand leading screws to the hollow shaft of the second spur wheel, and drill a hole through them as well as through the hollow shaft to receive the fastening pin. Now remove the longitudinal feed screw of the slide rest and attach to one side of the carriage an adjustable socket for receiving nuts filled to the leading screws. The number of leading screws required will depend of course on the variety of threads it is desired to cut, unless a change of gear is provided. 2. A writer in a foreign journal claims to make slides, or V-shaped pieces for slide rests, eccentric chucks, etc., on his lathe. Is any such process known here, or any process within the capabilities of an amateur mechanic by which the planing machine can be dispensed with? A. For small work held between the lathe centers a milling device fitted to the slide rest in place of the tool post will answer an excellent purpose. This device consists of a mandrel carrying at one end the cutter and at the other end a large pulley. This mandrel is journaled in a hinged frame supported by a block replacing the tool post, and is adjusted as to height by a screw passing through an arm projecting from the supporting block. The direction of the belt is adapted to this device by means of pulleys.

(12) J. E. B. asks: 1. What is the best turbine water wheel now in use? A. There are several wheels in market that seem equally good. You should examine all of them and decide from your own observation which is best. 2. What is the rule for finding the horse power of water acting through a turbine wheel which utilizes 80 per cent of the water? A. Finding the weight of water falling over the dam and its velocity in feet per minute, multiply the weight in pounds by the velocity, and the result is foot pounds, divided by 33,000, the quotient is theoretical horse power; if your wheel gives out 80 per cent, then 80 per cent of that result is the horse power of the wheel. 3. How can I calculate the capacity of a belt? A. You will find an exhaustive article on the subject of belts on pp. 101, 102, Vol. 42, Scientific American, which contains the information you desire. 4. What machine now in use is the best, all things considered, for the manufacture of ground wood pulp? Where are they manufactured? A. This information can probably be obtained by inserting an advertisement in the Business and Personal column of this paper.

(13) C. A. R. writes: Wishing to renew my Leclanche batteries, which were giving out, I bought some new empty porous cells. Please give the following information: 1. Can I use the carbon plates of the old elements over again? If so, do they need to undergo any washing or soaking; or are they as good as ever? A. Yes. Soak them for a few hours in warm water. 2. Is there anything I must add to the granular manganese with which I fill the cells, in order to obtain maximum power and endurance? Some makers add pulverized or even coarsely broken carbon. Is it an advantage? A. It is an advantage to add granulated carbon to the manganese. Use equal parts of each. 3. What is the exact composition of the curdy mass which forms around and especially underneath the zincs of newly mounted and old gravity batteries. Is this substance formed naturally, or is it the result of using poor zinc or sulphate of copper? A. It is copper, and should be removed, for it weakens the battery. It is the result of placing the zinc in the sulphate of copper solution. 4. Is there any real advantage in amalgamating the zincs of the above batteries? A. No. 5. Is there a speedy way of cleaning them when coated with this substance? A. They can be cleaned by scraping. 6. At certain occasions my electric bells began ringing without anybody apparently closing the circuit. I often notice that if I unjoin the batteries and let them remain thus for a few hours, on reconnecting them the bells would work all right for a week, sometimes a fortnight, when the same trouble would again occur. Can you in any way explain this phenomenon? The batteries are not placed in a very dry part of the house, but the wires, which run pretty closely together, are nearly all exposed, so that I can control the slightest corrosion or uncovering of the conductors. A. There must be some accidental closing of the circuit. We could not explain the action of your line without seeing it.

(14) J. E. E. asks: What is the number of layers of wire, and the size used for the primary of the induction coil in the Blake transmitter, and as near as you can the amount used for secondary? A. For primary, use three layers of No. 20 magnet wire, and for the secondary use twelve or fourteen layers of No. 36 silk covered copper wire. The resistance of the secondary wire should be from 100 to 150 ohms.

(15) J. M. I. asks how to make a barometer by coloring ribbon, so that they will change color, indicating weather changes. A. Use a moderately strong solution of chloride of cobalt in water.

(16) O. C. H. writes: In reply to R. A. R., question 22, in Scientific American, December 4, I will say that some months ago I was engaged in running a saw mill, lathe, and shingle factory; was troubled with two hot boxes, and frequently had to stop and apply ice. Seeing in the Scientific American a reference to the use of plumbago, I sent for some, and after three or four applications was troubled no more with hot boxes.

(17) F. W. asks: What is the best way for return pipe to go into the boiler from radiators—steam at 60 lb. per square inch, fall 15 feet? A. If your job is properly piped you can bring your return pipe in at any convenient place in your boiler below the water line. If you go into the feed pipe, have your connection inside all other valves.

(18) L. T. G. writes: 1. I have four cells of carbon battery; the solutions are bichromate of potash and sulphuric acid. Also three cells of the Smee: sulphuric acid one part, to ten of water; and the four cells of the carbon battery are not sufficient to run my small electro-magnetic engine. for more than two or three minutes. I wish to know if it would be injurious to either one of the batteries if I should unite them both in one circuit, to run the engine. for about one or two hours at a time. A. The batteries will not be injured, but they will not work well together. Better increase the number of carbon elements. 2. Will either of the above batteries freeze in winter, or will cold weather affect their working? A. They will not freeze, but it is better to keep them at a temperature above freezing. 3. Is it always best to use the largest wire in connecting batteries with any instrument, say, above No. 11 or No 12 wire, as the larger the wire the less the resistance, thereby getting nearly the full power of the battery? A. Yes. 4. What purposes are quantity and intensity electricity best suited for respectively? A. Batteries are arranged for quantity or intensity according to the work to be done. The maximum effect is obtained when the battery elements are combined, so that the total resistance in the elements is equal to the resistance of the rest of the circuit.

(19) J. H. asks: Which would be the strongest, two 2-inch by 4-inch joists nailed together, or one 4-inch by 4-inch joist? A. One 4-inch by 4-inch.

(20) J. K. B. writes: I suppose every experimenter who uses a carbon battery has been troubled by the uncertainty of the carbon connection. The makers of the Grenet battery seem to have solved the problem. Can you tell us through your correspondence column what solder they use, and how they make it stick? A. The carbon is coated with copper by electro-deposition; this coating is readily soldered to the carbon support with common soft solder.

(21) M. D. M. asks: 1. Is there a difference in a steam engine between the boiler pressure and the pressure on the piston when the piston is moving 400 feet per minute? A. Yes. 2. About what difference? A. From 2 to 8 lb., depending upon size and length of steam pipe. 3. Does the difference between them vary with a difference in the motion of the piston in the same engine? A. Not appreciably within usual limits of speed.

(22) F. writes: We have just closed up our steam stone works for this season, and we wish to know what is best to coat the inside of our steam boilers to keep them from rusting. Some say black oil, and others common tallow; which do you recommend as the best? A. We think the black oil quite as good and cheaper than tallow. Have the surfaces thoroughly cleaned before applying the oil.

(23) C. H. asks for a cheap and easy way of amalgamating battery zincs. A. It depends on the kind of battery. In the Fuller the mercury is placed in the porous cell with the zinc. In bichromate batteries all that is necessary is to dip the zinc in the bichromate solution and then pour on a drop or two of mercury. It soon spreads over the entire surface of the zinc. Another method is to dip the zincs in dilute sulphuric acid and then pour on a little mercury, but these methods, except in the case of the Fuller battery, are wasteful of mercury. It is better to apply an amalgamating solution with a brush. This solution is made by dissolving one part (by weight) of mercury in five parts of nitro-muriatic acid (nitric acid one part, muriatic acid three parts), heating the solution moderately to quicken the action; and, after complete solution, add five parts more of nitro-muriatic acid.

(24) G. W. asks: 1. Would a perfectly round ball of the same specific gravity throughout lie still on a level surface? A. Yes. 2. Can a mechanic's square be made so true that a four-inch block may be made exactly square by such an instrument? A. Yes.

(25) W. H. asks: 1. What is the weight of a boiler 24 feet long, 44 inches diameter, ¼ inch thick? A. With two flues, 16 inches diameter, 6,900 lb. 2. What is the contents (in gallons) of a tank 15 feet deep, 10 feet in diameter, top and bottom diameters being equal? Please give me a formula. A. Area of 10 feet diameter $=78{\cdot}54\times15$ feet deep$=1{,}178$ cubic feet, and, allowing 7½ gallons per cubic foot$=1{,}178\times7{\cdot}5=8{,}835$ gallons.

(26) C. L. W. writes: I have constructed a small induction coil to be used for giving shocks. It is 3 inches long. The primary coil is wound with 3 layers of No. 18 cotton covered wire, and the secondary consists of about 12 layers of No. 38 silk covered. 1. How many cells and what kind of battery shall I use to get the best results? A. For temporary use one cell of Grenet battery would answer, but for continued use some form of sulphate of copper battery is to be preferred. 2. Is it necessary that the spring and screw in the interrupter should be coated with platinum? A. Yes; otherwise they would soon burn out.

(27) H. C. P. writes: In the SCIENTIFIC AMERICAN of September 18, Mr. E. Y. D., query 26, asks whether a sun dial, made for latitude 48° 15′, can be utilized in latitude 38° 50′ for showing correct time. To make his dial available in the lower latitudes, he has only to lift the south side, so as to give the face a slope to the north, equal to the difference of the latitude, in this case 9° 25′. For then the plane of the gnomon being in the plane of the meridian, the edge of the gnomon casting the shadow will be parallel with the earth's axis; and the face of the dial will be parallel with the horizon of the latitude for which the dial was made, and the graduation will show the time required; that is, on the supposition that it was correctly made, and for a horizontal dial.

(28) C. M. M. asks for a cheap process of plating steel case knives with tin. A. Clean the metal thoroughly by boiling in strong potash water, rinsing, pickling in dilute sulphuric acid, and scouring with a stiff brush and fine sand. Pass through strong aqueous salammoniac solution, then plunge in hot oil (palm or tallow). When thoroughly heated remove and dip in a pot of fused tin (grain tin) covered with tallow. When tinned, drain in oil pot and rub with a bunch of hemp. Clean and polish in hot sawdust.

(29) V. R. P. writes: I have an aquarium which contains 4⅜ gallons of water. How many fish must I have in it—average length of fish 1½ to 2 inches, to insure the health of the fish? At present, I refill the aquarium semi-weekly. Please tell me a process by which I can lengthen the time. A. Put in three fish, 1½ inches in length, to one gallon of water, one small bunch of fresh water plants to one gallon of water. Tadpoles (after they have cast their branchia or gills), newts, and rock fish can be used to the extent of six to the gallon. The aquatic plants will supply the fish with sufficient oxygen, so that the water will seldom require changing.

(30) A. S. writes: I am about to construct an aqueduct 1,200 feet in length, the water level differing 40 feet. By placing a forcing pump in the valley I could then raise the water to a height of 40 feet, and having erected a tank at that height and connected it by means of pipes with another tank 1,200 feet distant, but on the same level, the water according to a law of nature would travel over the distance of 1,200 feet. But finding it very difficult to erect tank 40 feet high, I would prefer to construct the whole on the incline. Will the forcing pump having just power enough to raise the water 40 feet perpendicularly into the tank have sufficient power to force it into a tank of the same elevation through 1,200 feet of pipe running on the incline, or must I have more power, and how much more? A. The forcing pump must have enough more power to overcome its own additional friction and the friction of water in the long inclined pipe. Allow 20 per cent more power at least.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Box marked C. H. (no letter.)—1 and 2. Garnetiferous quartz rock. 3 and 4. Micaceous quartz rock. 5. Granite. 6. Basalt with traces of chalcopyrite.—L. C.G. —They are fossil sharks' teeth, common in marl beds.—J. E. C.—1. Iron sulphide and lead sulphide. 2. Quartzite, with traces of galena and molybdic sulphide. 3 and 4. Dolomite. 5. Fossiliferous argillaceous limestone, containing traces of lead sulphide. 6. Lead sulphide in argillite.—C. T. M.—1. A silicious kaolin. 2. Similar to No. 1. Useful if mixed with finer clay for white ware. 3. Silicious carbonate of lime—some of this would probably make fair cement. 4. Brick—the clay from which this was made would probably be useful to potters. 5 and 6 are very silicious clays.

COMMUNICATIONS RECEIVED.

Liniment. By J. L. T.

Seen and Tangible and the Unseen and Intangible. By J. L. T.

On Cheap Railroads. By R. P. N.

On a Meteor. By W. E. C.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 16, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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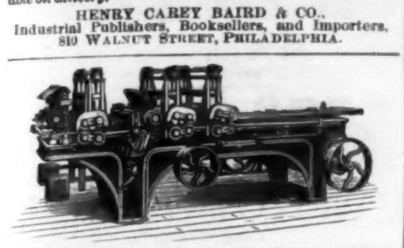

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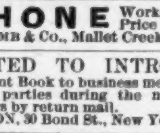

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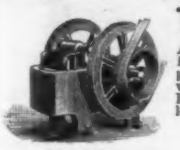

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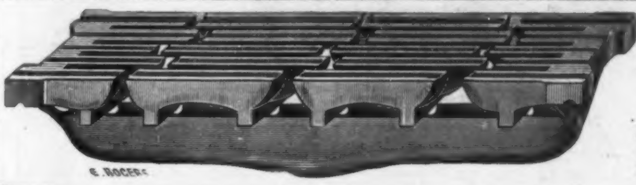

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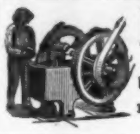

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This machine has for twenty years stood the TEST, and found to be the *best one* made for breaking all kinds of hard and brittle substances, such as ORES, QUARTZ, EMERY, etc., etc. Mr. S. L. Marsden, for the past twenty years connected with the manufacture of this machine, superintends its manufacture.

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The most marvellous mechanical invention of the age. It will play any tune that ever was written, in a melodious and pleasing manner. Difficult and simple music produced in a masterly style, and it can be played by a child as well as by a grown person, and will furnish music for social gatherings of any description, playing hour after hour, without any knowledge of music being required in the operation. The most wonderful of all musical inventions; a machine which in a purely mechanical manner produces any kind of music, Waltzes, Polkas, Marches, &c., &c., without any practice or knowledge of music whatever; in this respect far superior to any music-box, even though it costs many times as much, for there is no limit whatever to the number of tunes it will play. This instrument is on a somewhat similar principle to the wonderful Phonograph, the perforations in a flexible strip producing the effect. It has just been perfected (the accompanying cut showing it in its improved form), and is having the largest sale ever obtained by a musical instrument in the country. It has solid metal cases in imitation of green bronze; the notes or bars (the music producers) are metal, on same principle as a tuning-fork, which produce clear and most melodious notes, and never get out of tune; the bars are struck by strikers, the same as the wires are in a piano, only they work automatically instead of by the fingers. The strip of prepared paper in which the tune is stamped or perforated, is about 10 inches wide, and as it passes through the rollers and over the keys the strikers spring through the perforations in the paper and strike the right note; this is all done automatically, without any assistance from the operator (except turning the rollers), and the tune is played perfectly. It would be one of the most appropriate presents to make anyone, especially where there is no other musical instrument. Its execution is admirable, and its capacity or capability almost unlimited. It is selling faster than any musical instrument ever invented. The music is fine, and everybody delighted. The regular retail price of the Melodette is only **$5**, including a selection of popular tunes. Address, **The Massachusetts Organ Co.**, 57 WASHINGTON STREET BOSTON, MASS., U. S. A., Sole Manufacturers. SPECIAL OFFER—Agents Wanted—We wish a good Agent in every town, and big money can be made selling these instruments. We will send a sample instrument to any one wishing to act as our agent, for **$3.25**, BOXED FREE, including music price lists, etc., etc., and will give territory. Order at once. $30 a week easily made. We have 100 testimonials.

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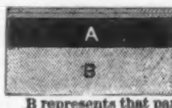

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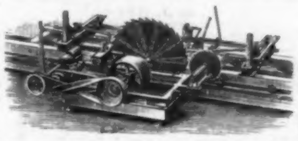

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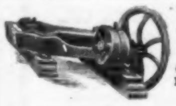

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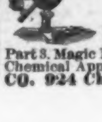

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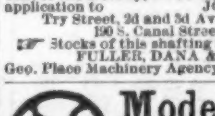

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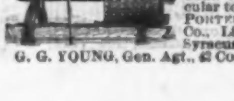

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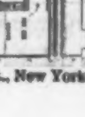

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